EVALUATING THE EFFECTIVENESS OF TELEVISION ADVERTISING SCHEDULES IN TERMS OF ADVERTISING EXPOSURE

By

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This work is dedicated to my wife, Hwa Yeon Kim, my mother, Young Hee Park, and my two beloved sons, Do Hyun and Do Yub, who have been and will be an eternal fountain of love, support, praying, and encouragement, throughout my whole life.

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TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS iv

LIST OF TABLES x

LIST OF FIGURES xi

ABSTRACT xii

CHAPTERS

I INTRODUCTION 1

Advertising Exposure Vs. Vehicle Exposure 2
Strategic Problems underlying the Evaluation of Television Advertising Schedules 4

The First Strategic Problem 4
The Second Strategic Problem 7

Purpose of the Study 8
Rationale 9
The Scope of This Study 11
Organization of the Dissertation 12

II LITERATURE REVIEW 13

Prior Research on Differences Between Vehicle and Advertising Exposures 13
Prior Research on Equating Vehicle Exposures to Advertising Exposures 19
Weighting 20

The Use of Weighting in the Advertising Industry 21
Leckenby and Wedding's Approach 22
Lancaster and Katz' Approach 22
The Use of Weighting in Media Selection Models 24
The Criticisms of Weighting 27

III BACKGROUND INFORMATION 29

The Media Planning Process 29
The ARF Model 33
Four Concepts of Media and Advertising Audience Measurements 36
Operational Definition of Media Evaluation 38
Television Media Evaluation Factors 39

Reach 40
Frequency 41
Gross Rating Points (GRPs) 42
Effective Frequency 42
Effective Reach 44
Exposure (or Frequency) Distributions 44
Cost Per Thousand (CPM) 45
Cost Per Point (CPP) 45

Characteristics of Television in the United States 45
Characteristics of Television in Korea 47

Overview 47
Television Networks and Coverage in Korea 49
Television Broadcasting Hours and Time Classification 50
Television Commercial Sales Types and Costs 52

Program commercials 52
Spot commercials 52
ID card commercials and sports 53

Lead Time for Placement 54

IV ESTIMATING VEHICLE AND MESSAGE EXPOSURE DISTRIBUTIONS OF TELEVISION ADVERTISING SCHEDULES 55

Media Evaluation Models 56
The Beta Binomial Distribution with Limited Information (BBD-L) Model 60
Source of Vehicle and Message Ratings 61

Vehicle Ratings 61
Message Ratings 63

Factors that affect message ratings 65

Korean Vehicle and Message Rating Data 66

The AGB peoplemeter 4900 system 67
Telescope and PCTIPS softwares 68
Characteristics of Korean vehicle and message ratings 68

Relationship Between Vehicle and Message Ratings 71

V. METHOD 76

Sampling 77
The Tests of Research Hypotheses 79

Purposes 79
Research Hypotheses 81

Equality of vehicle and message exposure distributions 81
Direction of differences between vehicle and message exposure distribution curves 82

Testing Procedures 83

The Development of the Regression Equation Model for Estimating Message Exposure Distributions of Network Television Advertising Schedules 88

Purposes 88
Procedures for Developing the Regression Equation Model 90

The use of the curve fitting approach 90
Decision on predictor (independent) variables 92

VI. RESULTS 94

The Results of the Tests of Hypotheses 94

Test of an Equality of Vehicle and Message Exposure Distributions 94
Direction of Differences Between Vehicle and Message Exposure Distribution Curves 96

Test of differences in the intercept between vehicle and message exposure distribution curves 96
Test of differences in the slope between vehicle and message exposure distribution curves 100

Suggestion of the Specific Forms of the Regression Equation Models 101
The Test of the Accuracy of the Double Log-Linear Model 104

The Four Definitions of Error 104
The Results of the Test of the Accuracy of the Double Log-Linear Model 107

VII SUMMARY, CONCLUSIONS, AND IMPLICATIONS 109

Summary and Conclusions 109
Implications 111
Limitations 113
Suggestion for Further Research 114

APPENDICES

A AVERAGE KOREAN NETWORK TELEVISION VEHICLE, NETWORK MESSAGE, AND SPOT MESSAGE RATINGS IN 1993 116

B ORIGINAL KOREAN NETWORK TELEVISION VEHICLE, NETWORK MESSAGE, AND SPOT MESSAGE RATINGS IN 1993 118

C THE SAMPLE BBD-L AND DOUBLE LOG-LINEAR MODEL RUN OUTPUT WITH DATA BASE TABLE 123

D COMPUTER BASIC PROGRAM FOR NETWORK TELEVISION ADVERTISING SCHEDULE EVALUATION MODEL 128

REFERENCES 135

BIOGRAPHICAL SKETCH 142

LIST OF TABLES

Table		Page
1	Differences Between Vehicle exposures and Advertising exposures	18
2	Prior Studies on Weighting Approaches	26
3	Four Concepts of Media and Advertising Audience Measurements	36
4	Dimensions of Four Concepts of Media and Advertising Audience Measurements	37
5	Television Networks and Coverage in Korea	49
6	Television Broadcasting Hours and Time Classification with Program Types	51
7	Korean Television Commercial Time Rates (US $)	53
8	Periods, Stations, and Types of Vehicle and Message Ratings	67
9	Mean and Standard Deviation of Vehicle and Message Ratings (N=184)	69
10	Two-way ANOVA Source Table (N=179)	70
11	Characteristics of Sample Television Advertising Schedules (N=508)	78
12	The Results of Regression of Vehicle, Message, and Pooled Exposure Distributions	95
13	The Specific Forms of the Regression Equation Models	102
14	Four Definitions of Error	106
15	Average Errors in Reach and the Distribution for the Double Log-Linear Model	107
16	Number of Over-, Under-, and Close-Estimations Within Plus and Minus Five Percent of the BBD-L's Reach and Exposure Distribution (in Number and Percent)	108

LIST OF FIGURES

Figure		Page
1	Hierarchy of the ARF Media Evaluation Model	33
2	Differences Between Vehicle and Network and Spot Message Ratings	72
3	No Intersection Between Two Curves	97
4	Intersection Between One and Two Frequency Levels	98
5	Intersection Between Two and Three Frequency Levels	98
6	Intersection Between Three and Four Frequency Levels	99

Abstract of Dissertation Presented to the Graduate School
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The primary objective of this study is to examine how the discrepancy between media vehicle and advertising exposures has an impact on the evaluation of television advertising schedules by empirically comparing vehicle exposure distributions with message exposure distributions of network television advertising schedules.

Three hypotheses are tested: 1) are there statistically significant differences between vehicle and message exposure distributions of network television advertising schedules, 2) are there statistically significant differences in the intercept between the vehicle and the message exposure distributions curves, and 3) are there statistically significant differences in the slope between the vehicle and the message exposure distributions curves?

A total sample of 1,016 vehicle and message exposure distributions obtained from 508 Korean network television advertising schedules were evaluated using regression analysis and F-tests. The results of the F-tests show that not only do statistically significant differences exist between the vehicle and message exposure

distributions, but differences exist in the intercept and the slope between the vehicle and message exposure distribution curves.

These empirical findings suggest that using vehicle rating data as inputs in the estimation of media evaluation factors such as reach, frequency, effective reach, gross rating points (GRPs), and exposure (or frequency) distributions can indeed mislead media planners to the evaluation of the impact of television advertising schedules on target audiences. This can subsequently distort the selection of the optimal schedule to deliver an advertising message to the extent that advertising and marketing objectives are achieved.

Another objective of this study is to develop an accurate, parsimonious, consistent, and reliable method to estimate message exposure distributions of network television advertising schedules. This study developed a total of eleven regression equation models to be used to predict message exposure distributions as a function of vehicle exposure distributions and other schedule characteristics, such as vehicle gross rating points (vehicle GRPs), frequency, the number of insertions and programs.

The eleven models developed are quite accurate in predicting message exposure distributions of network television advertising schedules with an adjusted R square ranging from .851 to .997. The most accurate model is the double log-linear model of which the adjusted R square is .997. The double log-Linear model can be used by media planners to estimate message audiences and thus to incorporate these estimates of message audiences into developing and evaluating network television advertising schedules in terms of advertising exposure.

In summary, this study is an attempt to get closer to establishing the value a brand receives for its dollars by evaluating network television advertising schedules in terms of advertising exposure rather than vehicle exposure.

CHAPTER I
INTRODUCTION

Advertising Exposure Vs. Vehicle Exposure

One of the dominating criteria of evaluating the performance of a media vehicle is its rating, which is defined as the number of people exposed to a media vehicle expressed as a percentage of a selected population base. This rating has been used as a major standard measure of the performance of media vehicles in terms of advertising message delivery.

The rating does not tell what percent of the target audience is exposed to an advertising message within the vehicle because the rating is the measure of whether people saw or looked into the vehicle, not a given ad in the vehicle. That is, the rating is the vehicle audience of a particular vehicle, not the advertising audience of that vehicle. The vehicle audience or vehicle rating is defined as the number or percent of audience members exposed to a vehicle, while the advertising audience or message rating is the number or percent of audiences exposed to an advertising message within the vehicle.

The vehicle audience does not equal the advertising audience. A conceptual problem inherent in the rating, which is the difference between advertising exposure and vehicle exposure, accounts for why the vehicle audience is different from the advertising audience.

Vehicle exposure is different from advertising exposure. Vehicle exposure is defined as a count of target audience members exposed to a vehicle, while advertising page exposure is a count of targets exposed to an advertising message. Technically, vehicle exposure means open eyes or ears facing the vehicle while advertising page exposure means open eyes or ears facing advertisements (Sissors, 1983). It is known that there is no one-to-one relationship between the two. "Vehicle exposure represents an opportunity-to-see. The number of opportunities-to-see that a media vehicle develops does not guarantee any exposure to advertising" (Sissors & Surmanek, 1986, p. 274). "Target members may not open a magazine to an advertiser's page. They may leave the room, or turn the channel, or 'zap' during a television commercial" (Lancaster & Katz, 1988, p. 3-1). That is, vehicle exposure is "a necessary condition for advertising exposure, but it is not a sufficient condition. There can be exposure to the vehicle without exposure to the advertising" (Joyce, 1984, p. 3). Therefore, the vehicle audience is generally bigger than the advertising audience for both magazines and televisions (Gomer & Vedder, 1964; Barclay, Doub, & McMurtrey, 1965; Mediamark Research Inc., 1983).

It is advertising exposure that is of ultimate interest, not vehicle exposure, because the cognitive process of advertising is initiated by exposure to advertising, which ultimately leads to a variety of anticipated outcomes.

Despite the importance of advertising exposure in evaluating a media vehicle, many media practitioners still assume that vehicle exposure is identical to advertising exposure; that is, "after audiences are exposed to vehicles, they automatically are exposed to ads, and almost as automatically they are finally converted to readers and listeners of ads" (Kreshel et al., 1985, p. 33). The primary reason why many media practitioners still assume that vehicle exposure is advertising exposure might be either

the lack of advertising exposure data or the technical difficulty to measure advertising exposures.

The conceptual problem, which is the discrepancy between vehicle and advertising exposures, could lead to the differences between vehicle and message ratings. There could be potential errors or bias in the estimation of media evaluation factors such as reach, frequency, effective reach, and exposure (or frequency distributions) resulting from the differences between vehicle and message ratings. *Reach* is the proportion of the population which is exposed at least once to the vehicles or messages in an advertising schedule. *Frequency (or average frequency)* is the average number of times target audience members are exposed to the vehicles or messages in an advertising schedule. *Gross rating points (GRPs)* are a crude or gross measure of audience expressed as the sum of all vehicle or message rating points delivered by a particular media schedule; they are also expressed as the product of reach and average frequency. *Effective reach* is the percentage of the target audience exposed to the vehicles or messages in an advertising schedule a sufficient number of times to produce a positive change in awareness, attitude, or purchasing action. *Exposure (or frequency) distribution* is the percentage of the target audience exposed at each frequency level of a media schedule. The selection of the media advertising schedule suitable to a particular brand is generally based on one or all of these media evaluation factors.

Media planners will face several strategic problems when they evaluate the impact of television advertising schedules in terms of these media evaluation factors.

The following section will discuss potential estimation errors or bias resulting from the differences between vehicle and message ratings, along with the strategic problems resulting from these estimation errors or bias.

Strategic Problems Underlying the Evaluation of Television Advertising Schedules

The First Strategic Problem

One of the fundamental media planning practices is media evaluation, which is defined as evaluating the likely impact of an advertising schedule on the target audience. Media evaluation primarily aims at selecting the optimal advertising schedule which delivers an advertising message to the extent that the media, advertising, and marketing objectives are achieved.

Traditionally, television media advertising schedules are evaluated in terms of quantitative media evaluation factors (or audience exposure patterns) such as reach, frequency, effective reach, gross rating points (GRPs), and exposure (or frequency) distributions. These quantitative media evaluation factors are derived from the media audience research data such as ratings and duplication information provided by syndicated media research services such as A. C. Nielsen, Mediamark Research Inc. (MRI), and Simmons Market Research Bureau (SMRB). Duplication involves "cross-pair (between-vehicle) audience rating" where it is the number or percent of people in one vehicle's audience who are also exposed to another vehicle, and "self-pair (within-vehicle) audience rating" where it is the number or percent of people who are exposed to different insertions of the same vehicle.

Media evaluation factors such as reach, frequency, effective reach, gross rating points (GRPs), and exposure distribution are usually estimated using mathematical media models such as the beta binomial distribution (BBD) model. Using syndicated media audience data as inputs in the estimation of these media evaluation factors means that only vehicle reach, frequency, effective reach, gross rating points (GRPs), or

exposure distributions are being estimated because these syndicated media audience data are vehicle ratings, not message ratings. Vehicle (or program) reach, frequency, effective reach, gross rating points (GRPs), and exposure distributions are audience exposure patterns to the vehicles (or programs) in a television advertising schedule as opposed to message reach, frequency, effective reach, gross rating points (GRPs), and exposure distributions which are audience exposure patterns to the advertising messages (or commercials) in the schedule.

There could be potential errors or bias in the estimation of true media evaluation factors such as message reach, effective reach, gross rating points (GRPs), and exposure distributions resulting from the differences between vehicle and message ratings. Message reach is the percentage of the target audience exposed at least once to the messages in an advertising schedule. Message effective reach is the percentage of the target audience exposed to the messages in an advertising schedule some minimum number of times or more in order for the messages to have some measurable impact on the target audience. Message gross rating points (GRPs) are a crude or gross measure of audience expressed as the sum of all message rating points delivered by a particular media schedule. Message exposure distribution is the percentage of the target audience exposed to the messages in an advertising schedule at each frequency level of the schedule.

More specifically, the proportion of the difference between vehicle and message ratings might lead to the overestimate of the message reach of a television advertising schedule, for example. The overestimation of the message reach means that the proportion of the target audience exposed to vehicles in the schedule (i.e., the vehicle reach) is bigger than the proportion of the target audience exposed to the ad in those vehicles (i.e., the message reach). This is because those counted as having been

"exposed" to the television advertising schedule have seen the television programs in the schedule, but not necessarily the commercials in the programs. The television advertising schedule selected based on the overestimation of message reach could not deliver as many advertising audience members as the schedule has, which, in turn, impedes the accomplishment of advertising and marketing objectives.

This discrepancy between vehicle and advertising exposures also makes it difficult to determine the optimal frequency level needed to achieve a particular message effective reach goal; therefore, it has limited the use of the effective frequency and reach concepts in practice. For example, the percentage of the target audience exposed to three vehicle exposures could be different from that of the target audience exposed to three advertising exposures because some audience members might not watch a commercial during commercial breaks. Due to this discrepancy between vehicle and advertising exposures, media planners have been suspicious of the optimal frequency level needed to achieve this message effective reach media goal. This problem has made media planners avoid the applications of the effective frequency and reach concepts in developing the media objectives and strategies.

The differences between vehicle and message ratings also has to do with the erroneous estimation of message exposure distributions of a television advertising schedule because, for example, in the estimate of the frequency distribution of exposures to the schedule, those counted as having been "exposed" at each frequency level of the television advertising schedule have seen the programs in the schedule, not necessarily the commercials in the programs.

The first strategic problem facing media planners is how to overcome these potential estimation errors or bias resulting from the differences between vehicle and message ratings.

The Second Strategic Problem

The second strategic problem results from differences in the ratios of message ratings to vehicle ratings of television programs.

It is assumed that the ratios of message to vehicle ratings of individual television programs could be different from one another. Even though two programs have the same vehicle ratings, message ratings of these two programs could be different from each other. In this case, the one which has the bigger message rating (or higher message/vehicle ratio) delivers more impact on the target audience than does the one which has the smaller message rating (or lower message/vehicle ratio). That is, the magnitude of these two programs in terms of advertising exposure is not the same.

This magnitude problem can be extended to the evaluation of individual television advertising schedules. Suppose, even though two different television advertising schedules have the same impact (e.g., the same vehicle GRPs) on the target audience in terms of vehicle exposure, one schedule might produce more message gross rating points (GRPs) than does the other. In this case, the one which produces more message gross rating points (GRPs) is more effective in delivering the message to the target audience than the one which has fewer message gross rating points (GRPs). That is, the former has a bigger advertising magnitude than the latter.

The second strategic problem facing media planners is how to solve this magnitude problem resulting from the differences in the ratios of message to vehicle ratings to maximize the effectiveness of media planning. The first and second strategic problems can be solved by developing a way to estimate message reach, frequency, effective reach, or exposure distributions of television advertising schedules.

Purpose of the Study

There are two objectives in this study. The first objective is to test the hypotheses which suggest 1) that there are statistically significant differences between vehicle and message exposure distributions of network television advertising schedules and 2) there are statistically significant differences in the intercept and the slope between vehicle and message exposure distribution curves. This hypothesis testing could empirically shed light on the fundamental question about whether using syndicated media audience research data such as vehicle ratings could result in the erroneous estimation of true media evaluation factors such as message reach, frequency, or exposure distributions. These potential estimation errors or bias could lead media planners to the wrong evaluation of the impact of a television advertising schedule on the target audience so that it could impede the accomplishment of advertising and marketing objectives.

The second objective of this study is to develop an accurate, consistent, parsimonious, and reliable method to estimate message exposure distributions of network television advertising schedules. Specifically, this study aims at developing a regression equation model which can be used to predict message exposure distributions of network television advertising schedules as a function of vehicle exposure distributions and other readily available schedule characteristics such as gross rating points (GRPs), frequency levels, the number of programs, and the number of insertions. The curve fitting approach will be employed to develop this regression model. The specific procedures to carry out the two objectives of this study are described in the method chapter.

Rationale

It has been said that television advertising schedules should be developed and evaluated on the basis of advertising exposure rather than vehicle exposure. This is because media planners have been suspicious of potential estimation errors or bias such as the overestimation of message reach resulting from the discrepancy between vehicle and advertising exposures when syndicated media audience research data (e.g., vehicle ratings) are used as inputs in estimating media evaluation factors such as reach, frequency, effective reach, or exposure distributions.

Theoretically, it is obvious that evaluating television advertising schedules on the basis of advertising exposure allows media planners to overcome potential estimation errors or bias and thus to accurately estimate the impact of a television advertising schedule on the target audience.

For example, evaluating a television advertising schedule in terms of advertising exposure establishes advertising exposure as a basic unit of analysis of reach and frequency of the schedule and therefore makes it possible to accurately evaluate the impact of the television advertising schedule on the target audience. For example, establishing advertising exposure as a basic unit of analysis enables media planners to determine the optimal levels of effective reach and frequency needed to achieve the advertising goals. This accurate analysis of message effective reach and frequency further enables media planners to select the optimal schedule to deliver an advertising message designed to achieve advertising and marketing objectives.

Establishing advertising exposure as a basic unit of analysis also enables media planners to develop the right combination of message reach and frequency goals. Using vehicle ratings in the estimation of reach and frequency of a television

advertising schedule will not allow media planners to determine the right combination of the message reach and frequency of the schedule because, for example, message reach could be overestimated due to the discrepancy between vehicle and advertising exposures. It thus appears that television advertising schedules should be evaluated on the basis of advertising exposure rather than vehicle exposure.

To date, however, few attempts have been made to empirically examine whether using syndicated media audience research data (e.g., vehicle ratings) results in potential estimation errors or bias such as the overestimation of message reach or erroneous estimation of message effective reach or exposure distributions. This is primarily due to the lack of message audience data (e.g., message ratings) available to substantiate assumptions regarding whether using syndicated media audience data could lead to these estimation errors or bias.

This study will tackle this problem by empirically examine whether the discrepancy between vehicle and advertising exposures could result in the erroneous estimation of true media evaluation factors such as message reach, frequency, and exposure distributions. This can be done by testing hypotheses which empirically compare vehicle exposure distributions of network television advertising schedules with message exposure distributions of the schedules.

This study will also develop a way to evaluate television advertising schedules on the basis of advertising exposure. Since current weighting approaches, which use numerical weights (e.g., Gallup and Robinson recall scores) to adjust vehicle audiences into message audiences, are not accurate, consistent, and reliable, this study will aim at developing an accurate, consistent, parsimonious, and reliable regression equation model which can be used to estimate message exposure distributions of network television advertising schedules.

The Scope of This Study

This study deals with the strategic problems resulting from potential estimation errors or bias underlying evaluating television advertising schedules in terms of vehicle exposure. Potential estimation errors or bias result from one conceptual problem, which is the discrepancy between vehicle and advertising exposures.

This study first attempts to suggest empirical evidence regarding potential estimation errors or bias resulting from this discrepancy between vehicle and advertising exposures. This can be done by empirically examining the differences between vehicle and message exposure distributions of network television advertising schedules. Exposure distributions were chosen as criteria of evaluating the impact of a network television advertising schedule on the target audience because they are considered as one of the most important media evaluation factors by most media practitioners, researchers, and educators. Exposure distributions provide all information relevant to schedule delivery such as reach, average frequency, gross rating points (GRPs), effective reach, and exposure distributions.

This study also suggests a way to overcome the strategic problems resulting from the potential estimation errors or bias by developing the method to estimate true media evaluation factors. This can be done by developing the regression equation model used to estimate message exposure distributions of network television advertising schedules. Given resources such as television vehicle and message rating data and using the curve fitting approach, this study is capable of developing an accurate, consistent, parsimonious, and reliable regression equation model that could be used to estimate message exposure distributions from television daypart network advertising schedules.

Organization of the Dissertation

This dissertation is organized into seven chapters, the first chapter being an introduction which provides the conceptual framework within which this study is set, including the purpose, rationale, and scope for the study.

Chapter II presents a literature review related to the purpose of this study. The review includes prior research on differences between vehicle and advertising exposures, prior research on equating vehicle exposures to advertising exposures, and various weighting approaches used to estimate advertising audiences of television advertising schedules.

In Chapter III, background information including the media planning process, the ARF model, four concepts of media and advertising audience measurements, operational definition of media evaluation, television media evaluation factors, and characteristics of television in the U. S. and Korea are presented.

Chapter IV illustrates the method for estimating vehicle and message exposure distributions of network television advertising schedules, followed by source of vehicle and message ratings required as inputs for estimating vehicle and message exposure distributions of network television advertising schedules. Chapter V, the method chapter, describes sampling, the tests of research hypotheses, and the development of the regression equation model for estimating message exposure distributions of network television advertising schedules.

Chapter VI concerns the results of hypotheses testing and suggestions of the regression equation model used to estimate message exposure distributions of network television advertising schedules. Finally, summary, conclusions, implications, limitations, and suggestion for future research are presented in Chapter VII.

CHAPTER II
LITERATURE REVIEW

Most empirical findings related to the discrepancy between vehicle and advertising exposures have centered on 1) the magnitude of differences between the portion of vehicle exposures and that of advertising message exposures and 2) how many vehicle exposures are needed to achieve a particular number of advertising exposures. However, there are also some attempts to estimate advertising message audiences of an advertising schedule to evaluate the impact of the schedule on the target audience on the basis of advertising exposure.

This literature review is divided into three parts. The first part is concerned with the size of the differences that exist between the portion of vehicle exposures and that of advertising message exposures. The second part describes the study which attempted to equate vehicle exposures to advertising message exposures. The third part deals with various weighting approaches used to estimate advertising message audiences of media advertising schedules to evaluate the impact of an advertising schedule on the target audience in terms of advertising exposure.

Prior Research on Differences Between Vehicle and Advertising Exposures

The conceptual difference between advertising and vehicle exposures explains why there are differences between vehicle ratings and message ratings. Literature about the size of the differences between the portion of advertising audience exposures and

that of vehicle audience exposures has appeared in many advertising publications since the early 1960s. The findings were consistent regardless of media types, vehicle types, and methodological differences. A consensus of these findings is that there are clear differences between the portion of vehicle audience exposures and that of advertising audience exposures. The followings are a handful of these studies dealing with the issue of the differences between the portion of vehicle audience exposures and that of advertising message audience exposures.

The first article mentioning the difference between vehicle and advertising exposures was "Toward Better Media Comparison" reported by Advertising Research Foundation Audience Concepts Committee in 1961. The model that the ARF committee developed detailed six stages in the propagation and effect of the advertising messages. The model showed that advertising exposure and vehicle exposure are two different things in terms of the evaluation of media effectiveness. Chook (1983) later pointed out that we were still at the stage of vehicle exposure of the ARF model and needed to develop a full complement of advertising exposure to move beyond vehicle exposure to accurately evaluate and determine the effectiveness of media vehicles.

Nuttall (1962) performed surveys and a number of pilot studies to measure audience attention during commercials. He argued that the capacity of the television medium to expose advertisements varies with audience attentiveness, which has nothing to do with audience size as conventionally measured. The findings are (1) of those housewives who watched programs only about 30 percent were viewing during commercials, 70 percent being engaged in some other activity as well, (2) the quality of attention paid by viewers varies at different times, attention tending to increase at peak times (7:30-9:00 P.M.), and (3) identification of commercials varies with viewers' interest in programs.

The studies of television commercial exposure and recall (Gomer & Veddar, 1964) showed that the number of viewers possibly exposed to commercials is considerably fewer than the number who viewed the program, and the number of viewers recalling content of commercials is even less than that, for both Chicago and St. Louis. The percent of viewers exposed to commercials was 38 and 36 percent of the program rating for Chicago and St. Louis, respectively, while the percent of viewers recalling content of commercial was 20 and 16 percent of the program rating.

A study conducted by Allen in 1965 found that roughly a third of the time when the set was on during the evening there was no one in the room or paying attention to the set. A photographing device, was installed to record the family's normal viewing behavior at any pre-selected interval.

Steiner (1966) surveyed viewer behavior associated with television commercials. The finding of attention level was that 47 percent of the respondents paid full attention to all network commercials during commercial breaks while 37 percent of them paid partial attention, while 16 percent of them got up or did not pay attention to commercials. It was also found that the exposure level of continuing commercials was smaller than that of initial ones. There were not substantial differences between opening, middle, and closing commercials in terms of exposure level during commercials.

Bechtel, Achelpohl, and Akers (1972) videotaped the home viewing behavior of 96 subjects to assess the accuracy of diary measures of television viewing. The tapes were coded at two and one half minute intervals. The results showed there was no viewing during 46 percent of commercial time.

Bunn (1982) examined electricity usage during commercial breaks for five-to-ten minute political ads shown simultaneously on all television channels. He found that electricity usage significantly increased during the breaks.

In 1983, Television Audience Assessment (T. A. A.) conducted an experiment about the development of a qualitative rating system. One of their conclusions was that estimates of audience size alone do not give a true picture of a program's ability to deliver viewers for the commercials within the program.

Anderson et al. (1985) kept track of 5-year-olds' home viewing behavior using a video camera providing 4,672 hours of recordings. The results showed that children watched the television 67 percent of the time they were in a room when a television set was on. Children were engaged in other activities during 33 percent of the time a television set was on.

Yorke and Kitchen (1985) examined to what extent VCRs and television remote-controls affect consumer behavior during television commercial breaks in the United Kingdom. The result was that only 11 percent of the population thought they were highly likely to view the commercials at the end-program breaks, whereas 34 percent were highly likely to watch the commercials at mid-program breaks. The other behavioral choices are conversation, preparation of refreshments, flicking through channels, and reading a newspaper or other literature.

Heeter and Greenberg (1985) reported results of five proprietary surveys about commercial zapping. They found that remote-control-channel-selector owners reported avoiding seven percent more television commercial than non owners.

Bogart (1986) introduced a study using a stop-motion video camera, which was sponsored by the U. S. government. The study was made in 100 households in Springfield, Massachusetts. It showed that no one is in the room 15 percent of the time

the TV set is on and that when people are in the room, they are actually looking at the set three-fifths of the time. He pointed out that this research raised fundamental questions about the meaning of "audience" statistics, questions that have their counterparts for all other media.

Recently, Rust and Stout (1989) summarized various qualitative aspects of television viewing, which were presented in the conference, "Beyond Ratings: New Directions in Audience Measurement Research," held at Columbia University in 1985 as follows: (1) viewers of a television program do not pay attention to the television all the time (Anderson & Field, 1985); (2) viewers may be engaged in other activities while watching that distract their attention (Anderson & Field, 1985; Hoffman, 1985; Roberts, 1985); (3) different programs may have different impact (Hoffman, 1985; Roberts, 1985); (4) product usage within segments may differ for viewers and non-viewers (Garrick, 1985; Delaney, 1985); and (5) viewers of a television program may not see all of its advertisements (Spaeth, 1985).

In summary, regardless of methodology, it turned out that the audience exposure to a commercial was much lower than the exposure to the television program delivering the commercial. Total commercial avoidance ranged from 15 percent to 48 percent with observational methods of viewing behavior such as videotapes reporting higher levels of commercial avoidance than various self-report measures (Nuttall, 1962; Allen, 1965; Steiner, 1966; Ehrenberg & Twyman, 1967; Heeter & Greenberg, 1985; Yorke & Kitchen, 1985; Bogart, 1986). In addition, several studies showed that the levels of television-commercial exposure avoidance for viewers with remote-control channel switchers varied, ranging from seven percent to 37 percent (Heeter & Greenberg, 1985, Kaplan, 1985). The literature on the differences between vehicle and advertising exposures is well summarized in Table 1.

Table 1
Differences between Vehicle Exposures and Advertising Exposures

Study	Method	# of Subjects	Observations
Allen (1965)	A camera of home viewing behavior.	358 Subjects	19% of the time TV was on, none were in the room. 48% of the ad time had no or an inattentive audience.
Anderson & Field (1985)	Videotapes of five-year-old home viewing behavior	99 families	33% of the time the TV was on, child not looking at TV.
Bechtel et al. (1972)	Videotapes of home viewing behavior.	96 Subjects	46% of ad time had no viewers.
Bunn (1982)	UK study found that electricity usage jumped during commercial breaks	21 observations	Not available
Bogart (1986)	A stop-motion video camera	100 households	15% of the time TV set is on, none were in the room.
Gomer & Veddar (1964)	A personal interview	Not available	Only 36% of program audiences watched the ad. 18% of them recalled the contents of the ad.
Heeter & Greenberg (1985)	Five different surveys in the past two years	Not available	Remote-control owners avoid seven percent more TV commercial than non owners.
Nuttall (1962)	Not available	Not available	30% watch and 70% engaged in other activities during commercial breaks.

Table 1- Continued

Study	Method	# of Subjects	Observations
Steiner (1966)	Used "spies" who wrote down behavior of their family when they watched TV at home.	47,823 ads	47% watch network ads (10.4% not in the room). 41.5% watch spot ads (12.81% not in the room).
Yorke & Kitchen (1985).	A personal interview	Four regional groups in the U. K.	11% likely view ads at end-program break. 31% likely watch ads at mid-program break.

Prior Research on Equating Vehicle Exposures to Advertising Exposures

One research study conducted by Kamin in 1978 attempted to relate vehicle exposures to advertising exposures using syndicated copy research data on communication effects such as Burke recall scores. Kamin (1978) attempted to bridge the gap between vehicle and advertising message exposures by plotting the exposure probabilities of a normal distribution curve on a graph relating the percent of probability of three advertising exposures against media vehicle frequency levels. The average Burke recall score, 25 percent, was employed as a weight to adjust vehicle exposures to estimate the probability of audience members exposed to the ad exactly three times. The results of his study showed that 26 percent of the program viewers saw the ad three times when vehicle exposures ranged from 11 to 12.

Weighting

The conceptual problem of the difference between vehicle and advertising exposures has made some media planners turn their attention to estimating message reach, frequency, effective reach, or exposure distributions rather than vehicle reach, frequency, effective reach, or exposure distributions . A survey conducted by Lancaster et al. in 1986 found that about one third (31%) of agencies studied attempted to estimate advertising exposures (Lancaster et al., 1986). However, a majority of media planners and advertising agencies still seldom attempt to estimate advertising message audiences from a television advertising schedule. They just consider vehicle and advertising message audiences of the television advertising schedule to be equal. Lancaster et al. (1986) found that "almost half (48.4%) of the agencies surveyed use vehicle audiences as a proxy of advertising audiences" when they were asked about the definition of effective reach (Lancaster et al., 1986, p. 25).

There are several reasons why media planners do not attempt to estimate advertising audiences from a magazine schedule (Abernethy, 1990). The main reason is that there are no such data as message ratings and self- and cross-pair ratings which can be used as inputs into media evaluation models to estimate advertising message audiences from television schedules.

Nevertheless, there have been some attempts to estimate advertising message audiences from a television advertising schedule. They are weighting approaches, which use as weights numerical values such as Starch noted recognition scores, Gallup and Robinson recall scores, or AdTel scores to adjust vehicle audiences into advertising message audiences.

Literature shows that in the advertising industry the most popular way to estimate advertising audiences from media schedules is weighting. The basic mechanism of weighting is that variable weights are applied to the proportion of media vehicle exposure distribution to yield advertising audiences or audience of other communication effects. The weights may be in the form of an index, percent, fraction, or ratio (Hall, 1980). Several types of weighting approaches have been developed and used by both the advertising industry and academia. They are as follows.

The Use of Weighting in the Advertising Industry

In 1986, Lancaster and et. al. surveyed the industrial use of weighting. The results showed that considerable numbers of agencies used weighting to adjust vehicle audiences into advertising audiences (Lancaster et al., 1986). Approximately one-third of major agencies weighted roughly half of their media plans for all media categories. The procedures they used were fairly straight forward. Applying variable weights to each vehicle rating was reported by 82 percent of the 28 agencies. Five (17.9%) executives reported that their agencies applied different weights to the percent of the target exposed to each frequency level of the schedule exposure distribution. One executive noted that a single weight was applied to the entire exposure distribution. Based on the survey, the major sources of weights they used to adjust vehicle audiences were the syndicated copy research data on communication effects such as Starch noted recognition scores, Gallup and Robinson recall scores, and AdTel scores, among others. Specifically, recall (58.5%) was the most frequently used communication effect, followed by advertising exposure (52.1%), awareness (47.9%), attentiveness (43.6%), purchase (31.9%), recognition (24.5%), and so forth.

Leckenby and Wedding's Approach

Leckenby and Wedding (1982) used a weighting approach to estimate so-called Message/Media Response values (MMRs) which are used as an indicator of message effective reach of a given magazine advertisement. In a particular media schedule after producing the vehicle exposure distribution, each level of vehicle exposure is multiplied by each copy research score on communication effects such as day-after recall (DAR) to obtain the message effective reach of the schedule. The Message/Media Response value is the sum of the effective reach figures calculated for each level of exposure. A variety of copy research data used as weights in this approach include advertising awareness, recognition, recall, attitude change, and intention-to-buy from a "hierarchy" of response types toward a product.

Lancaster and Katz' Approach

Lancaster and Katz (1988), in their book "Strategic Media Planning," suggested several types of weighting procedures which can be applied to various versions of the beta binomial distribution (BBD). Three possible options of weighting were (1) to weight all three audience ratings (single-insertion plus self- and cross-pair ratings) equally; (2) to weight available single-insertion audience ratings and use these to estimate weighted self- and cross-pair audience ratings; and (3) to obtain unweighted exposure distributions based on all three unweighted audience ratings and then to weight the percent of the target exposed at each frequency level. The first and third methods are fairly straight forward while the second method must develop and use regression equations to estimate message self- and cross-pair duplicated audiences.

It appears that the first method is the most accurate and reliable. However, all three methods seem to have problems. The problem of the first method lies in the assumption that the same weight is applied to both vehicle single-insertion and self- and cross-pair audience ratings. This prior assumption has not empirically been proved at all. The problem of the second method is that the regression equations developed to estimate message self- and cross-pair ratings may produce the estimation error because these regression equations are originally developed based on vehicle duplication ratings of which the size is much bigger than the size of message ratings. The third method is also problematic when it applies a single weight to all frequency levels of an advertising schedule. Different weights would be applied to each frequency level of an advertising schedule because, in the case of broadcast media such as televisions, for example, those who are exposed to the television programs in a television advertising schedule five times are not necessarily exposed to a commercial within the programs five times because some audience members might not watch the commercial. Applying weights that differ for each frequency level would more closely reflect the complexities of real world problems. Some major agencies have employed the third method using weights that differ for each frequency level (Lancaster & et. al., 1986).

Using the first method which applies the same weight to all three vehicle audience ratings to get message-single and self- and cross-pair ratings, Lancaster's media evaluation and allocation models, ADOPT and ADplus, estimate message exposure distributions of various media advertising schedules (Lancaster, 1987, 1988, 1993; The Media Group, 1989). Copy research data on communication effects such as recall scores were used as major sources of weights to estimate message exposure distributions in his models.

Recently, Cho (1992) adopted the first method to estimate message exposure distributions of magazine advertising schedules using his long-term consumer magazine optimization media evaluation model.

The Use of Weighting in Media Selection Models

Weighting approaches have also been seen in mathematical media selection models, which primarily aim at determining the optimal media schedule, given a set of alternative media vehicles and fixed budgets. These models incorporate weighting approaches into estimating the probability of exposure to an ad. The notable examples of these models are Gensch's AD-ME-SIM simulation model (1969), Aaker's ADMOD model (1975), and Rust's VIDEAC heuristic model (1981, 1985). While Gensch's and Aaker's models are to be used for both television and magazines, Rust's model is developed to select only television schedules.

First, the AD-ME-SIM model (Gensch, 1969), the most important development in simulation-based media selection models, incorporates several kinds of media weights to consider various types of qualitative effects of advertising messages. They were target population weights, vehicle appropriateness weights, commercial exposure weights, and commercial perception weights. "Target population weights" permit the emphasis of particular demographic groups. "Vehicle appropriateness weights" allow for the non-rating factors which influence the effectiveness of an ad. Gensch (1970) separated the concept of commercial exposure from that of commercial perception by noting that they are really quite different. He incorporated two different weighting systems into the model: commercial exposure weights and commercial perception weights. "Commercial exposure weights" involve the conditional probability of being

exposed to the commercial within a vehicle, given that one has been exposed to the vehicle. "Commercial perception weights" deal with levels of conscious perception of the ad (Rust & Stout, 1989).

In 1989, Rust and Stout suggested that the MEDIAC heuristic on-line media selection model, which was introduced by Little and Lodish in 1966 and updated in 1969, could incorporate an advertising exposure value by revising a program exposure. This model assumes that an individual exposed to a program is exposed to the ad. An individual is assumed to have an "exposure value" which goes up when the individual is exposed to an advertisement, but which otherwise decays over time. Rust and Stout said that advertising exposure value can be obtained by multiplying the conditional probability of exposure to an ad to program exposure. That is, $e_{ij*} = e_{ij}$ (Pr), where, e_{ij*} is ad exposure and e_{ij} is program exposure and (Pr) is the conditional probability of exposure to an ad.

In 1975, Aaker introduced the ADMOD advertising decision model as a successor to the MEDIAC model. The ADMOD also generated advertisement exposure probability on individuals in a given vehicle. It developed an equation as follows: $p = bh$ where b is the probability that individual i will be exposed to the vehicle j under consideration, h is the conditional probability of an exposure to an advertisement using copy alternative c in the vehicle j and the product of these two terms, p is the probability that individual i is exposed to an advertisements using copy approach c in vehicle j. The advertisement exposure probabilities conditional on vehicle exposure were obtained using the 1973 Starch ad norms, specifically, the seen-associated score which is the percent who associated the advertisers with the advertisement (Aaker, 1975).

Table 2
Prior Studies on Weighting Approaches

Study	Method	Application
Aaker (1975)	The use of the 1973 Starch ad norms as weights to estimate ad exposure probability conditional on vehicle exposure.	ADMOD advertising decision model. Used for TV & Magazines.
Gensch (1969)	The use of commercial exposure weights and commercial perception weights in the simulation media selection model.	AD-ME-SIM simulation-based media selection model. Used for TV & magazines.
Lancaster & Katz (1988)	Three different options of weighting procedures which can adjust vehicle audiences of a media schedule.	The beta binomial distribution model. Lancaster's ADplus media selection model (1994). Used for TV & magazines.
Leckenby & Wedding (1982)	The use of weights to estimate so-called Message/Media Response values (MMR's). Weights used are copy research data such as awareness, recognition, recall, and attitude change.	Any estimate of vehicle exposure distributions.
Rust & Klompmaker (1981)	The use of two kinds of weights to adjust television program exposure: the conditional probability of exposure to an ad within a program and the vehicle appropriateness weight.	VIDEAC heuristic-based television model.
Rust & Stout (1989)	The use of the conditional probability of exposure to an ad as weight to adjust television program exposure.	Little & Lodish's MEDIAC heuristic on-line media selection model. Used for TV & Magazines.

Besides these models, the VIDEAC heuristic-based model developed by Rust (1985) and Rust and Klompmaker (1981), a heuristic-based television allocation model, utilizes two kinds of weights: the conditional probability of exposure to an ad within a program and a vehicle appropriateness weight to incorporate various qualitative aspects of television viewing, in evaluating media schedules. The conditional probability of exposure to an ad within a program accommodates qualitative factors of television viewing such as "viewers do not pay attention to television" and "viewers may be engaged in other activities while watching." A vehicle appropriateness weight represents different values of an ad exposure. These weights might be allowed to vary by segment (Rust & Stout, 1989). VIDEAC also uses as a central component of its allocation procedure the concept of "effective exposure" to an advertisement. The probability of effective exposure was expressed numerically by the multiplication of the conditional probability of exposure to an ad within a program, a vehicle appropriateness weight, and the rating of program to segment.

The Criticisms of Weighting

No matter what a weighting procedure is, the effectiveness of weighting largely depends upon the selection of an appropriate weight for a particular media planning situation. To select an appropriate weight for a particular media planning situation is very difficult because "decision rules are likely to change from one product to the next one and, for the same product, from one creative execution to the next" (Lancaster & Katz, 1988, p. 3-9).

Many media planners use as weights the copy research data on communication effects such as Starch noted recognition scores and Gallup and Robinson recall scores.

Most of them have directly applied the copy research data on communication effects to vehicle exposures without adjusting them. For example, if the portion recalling the ad is 50 percent and the reach of the target audience exposed to the vehicle is 30 percent, the percentage of audience members exposed to the ad is obtained by multiplying 30 percent by 50 percent, which is 15 percent. "Some have criticized the use of Starch noted scores for media evaluation purposes because they are intended to be used as directional message indices" (Lancaster & Katz, 1988, p. 3-9). In estimating the reach and frequency of a magazine schedule, using the copy research data on communication effects as weights without adjusting them might significantly underestimate the message reach and frequency of the schedule, since the copy research scores on communication effects could be smaller than the percentage of advertising audiences. The evidence shows that the number of recalled commercials was significantly fewer than that of exposures to commercials (Gomer & Vedder, 1964).

To overcome this problem, recently Abernethy (1990) suggested an overall norm for the television exposure avoidance to be used by the advertising industry to adjust program audiences into commercial audiences. His research used previous studies of both physical and mechanical television advertising avoidance to derive an average television commercial avoidance rate of 32 percent (Abernethy, 1990). He argued that if accurate program audience data are available, commercial avoidance norms could be used to adjust program audience data into commercial audiences.

The weighting approaches employed by the advertising industry also cannot overcome the problem of a difference between single exposure and multiple exposures, which is too important for media planners to ignore. This is because they make no distinction between single exposure and multiple exposures on the evaluation of magazine schedule alternatives, for example.

CHAPTER III
BACKGROUND INFORMATION

The Media Planning Process

Media planning, the process of developing formal advertising objectives in the selected media, produces a concrete, quantified plan for achieving objectives (Rust, 1986). The media plan, which is the end result of media planning, is a blueprint of the forthcoming advertising problem of the firm (Bolen, 1984).

The scope of the media planning process includes not only a media plan platform but also pre-media planning activities. The most common elements of the media planning process include situation analyses, and developing media objectives, strategies, and tactics.

Media planning begins with situation analysis which is a pre-media planning activity. The main contribution of the situation analysis to media planning is to provide a framework within which media decisions are made, thereby assisting in the formulation of media objectives and strategies. Situation analysis consists of marketing and advertising situation analyses. Marketing situation analysis consists of analysis of consumers, product situation, market (e.g., history of market), distribution channels, competitive situation, marketing mix, and other uncontrollable variables such as economic conditions, the legal and cultural environment, and weather. Advertising situation analysis would require a consideration of advertising appropriation and

budget, competitive advertising spending, target audience, creative strategies, and the evaluation of the advertising message for the brand (Lancaster & Katz, 1988).

The individual marketing and advertising situation variables serve as both opportunities and constraints. Among those which affect the environment for media decisions the most are four elements of the marketing mix (product, price, promotion, and place or distribution) and constraints (e.g., budget, creative strategies, and media usage of competition).

Following situation analysis, media planners should define the target audience - those who are most likely to buy the product or act on the message. The target audience definition helps to specify the media objectives and strategies, i. e., media planners develop the media objectives and strategies most suited to reaching the target market. "The target audience may be defined in terms of any or all of three types of variables: (1) demographic, (2) sociopsychological, and (3) product usage" (Barban, Cristol, & Kopec, 1976, p. 32). Syndicated research services such as Simmons Market Research Bureau (SMRB) and Mediamark Research Inc. (MRI) provide the data on these audience profiles. The target audience might be further broken down into the primary and secondary target audiences based on individual marketing strategies.

After defining the target audience, media planners create measurable media objectives, which aim at implementing the advertising and marketing objectives. The important elements of media objectives are reach, frequency, and continuity. Determining the right combination of reach and frequency is important since the impact of reach and frequency are inversely related to each other. For example, given a fixed budget, the greater the frequency with which one reaches the target member by virtue of the media selected, the smaller the reach will be, and vice versa. In general, high levels of reach are necessary to obtain broad or cognitive advertising communication goals,

such as attention, awareness, and knowledge, while high levels of frequency are required to gain attitudinal and behavioral goals, such as liking, preference, conviction, and trial (Lancaster & Katz, 1988). High reach goals are required when new products are introduced to the markets whereas high frequency goals is needed when a market is highly competitive or when a product is sold frequently.

Besides reach, frequency, and continuity, various elements of target audience definition, geographic coverage, creative requirements, timing patterns, and effective reach goals are often included in the domain of media objectives.

Media objectives must be consistent with marketing and advertising objectives since they aim at accomplishing marketing and advertising objectives. A summary of marketing and advertising objectives is often included in the statement of media objectives in order to show that they were recognized in the media objectives. Lancaster and Katz (1988) summarized the relationship among them as follows:

> While marketing objectives deal with sales and the market share of the product, the advertising objectives are concerned with the communication effects that are required to help achieve marketing goals. Finally, media objectives consider the effective reach of the media plan that is needed to achieve advertising goals. (p. 5-1)

After target audience and media objectives are defined, media planners develop media strategies which consist of guidelines to be followed in implementing media objectives. Media strategies are the solutions to the media objectives. For example, "high reach goals demand media strategies that achieve low duplication within vehicles and between vehicles and media categories. High frequency goals, in contrast, need vehicle and media categories selection strategies that achieve high duplication" (Lancaster & Katz, 1988, p. 5-6).

Media strategies include weighting decisions on break-downs of target market (e.g., primary, secondary), geographic regions (e.g., national, spot), media types, and timing or scheduling. Based on the weighting decisions, media efforts such as budget and gross impressions will be allocated. For example, a good market which has a large population (e.g., New York) receives more gross impression than the other markets.

Strategic decisions are followed by tactical decisions of selecting media, vehicles, and the number of insertions in each vehicle. Tactical decisions specify and implement media strategic decisions. The media selection process involves two steps: (1) the selection of media classes (inter-media comparisons) and (2) the selection of vehicles and insertions within classes (intra-media comparisons). The key of selecting media classes is to identify appropriate media by matching the target audience for a product with users of specific media. For example, if a primary target audience consists of women ages 18 to 34, media alternatives such as women's magazines or TV soap operas would be efficient in reaching the target audience.

The selection of vehicles and insertions within media classes depends on their ability to deliver the selected target audience. The most common and elementary principle for selecting vehicles is to select vehicles that reach a large number of targets with the lowest cost-per-thousand impressions (CPM). Cost-per-thousand impressions (CPM) is the cost to achieve every thousand impressions using a particular vehicle or schedule (Lancaster & Katz, 1988). The best principle for selecting vehicles, however, is to determine the full extent of each vehicle's value in terms of the desired criteria and then to select from among them, those that best meet the criteria (Sissors & Surmanek, 1986). Generally, the combinations of quantitative and qualitative media factors serve as selection criteria. Quantitative media factors include ratings, costs, cost-per-thousand impressions (CPM), while qualitative media factors are the prestige of the

publication, a medium's environment, the quality of editorial content, and the quality of reproduction. In this stage, media planners consider constraints such as media uses of competition and creative strategy and might modify the selection of a particular media or vehicle.

After the optimal media schedule is selected, the actual buying of media space and time will be followed as the final process of media planning.

The ARF Model

The ARF media evaluation model will help to better understand the relationships between advertising exposure and various media's effects including vehicle exposure, advertising perception, advertising communication, and sales response.

In 1961, Audience Concepts Committee in the Advertising Research Foundation presented the ARF media evaluation model which involves six stages at which every media vehicle can be evaluated. The six stages are as below:

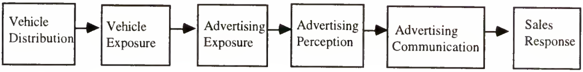

Figure 1. Hierarchy of the ARF Media Evaluation Model

The six stages represent various stages of media functions. The first stage is (1) vehicle distribution which is a count of the physical units through which the advertising is distributed. In case of television, this would be the number of sets tuned on a particular TV channel, while in the case of magazines this would be the number of

circulated copies. Following vehicle distribution is (2) vehicle exposure, which is defined as a count of target members who are exposed to the magazine or TV set. Vehicle exposure provides an opportunity to see advertising. (3) Advertising exposure is a count of the target members exposed to the advertising. This is a primary goal of advertising, that is, to be seen by consumers. (4) Advertising perception is a count of target members who see or hear advertising. Advertising perception is considered to be a cognitive effect of advertising. (5) Advertising communication is a count of target members whose responses to the product are in some way affected by the advertising. This stage refers to the affective domain of the hierarchy of communication effects. (6) Sales response is a count of target members who respond to the advertising with some sort of behavior. Sales response, which is the measure of the conative dimension of communication effects, includes the number of units purchased, the number of purchases, and the number of dollars spent, etc.

The six stages have a hierarchical relationship to each other. That is, each stage is the end result of the prior stage. The first three stages are different from the last three stages in that the first three stages represent physical effects of media vehicles, while the last three stages show psychological and behavioral effects of media vehicles. Notably, messages might have more impact on the last three stages than do media vehicles. Joyce (1964) said that the first three stages of this model relate primarily to the medium while the last three stages of the model are the responsibility of the advertising message itself (Joyce, 1984). The first stages are indeed necessary conditions to create the last three stages.

Among the first three stages, the most important is advertising exposure because the communication effects of the last three stages begin with advertising

exposure. In other words, cognitive processing of advertising is initiated by exposure to advertising, which may ultimately lead to purchase behavior.

Despite sales response as the most important final stage of the ARF media evaluation model, sales response cannot be used as the good measure of evaluating the performance of media vehicles. This is because sales response is influenced by many other intervening factors besides media vehicles. These variables include not only media, advertising, and marketing variables, but also other non-marketing situation variables such as the state of the economy.

Information Resources Inc. (IRI) analyzed the impact of advertising messages on sales by matching the number of a household's exposures to the commercial of a particular product with the pattern that the household purchases the product. The results showed that added advertising exposures do not necessarily result in additional purchase behavior or sales increases. Information Resources Inc. (IRI) is the biggest research service in the market in terms of the total revenues in 1993. The company provides single source data which combine television viewing data with product purchasing data for 3,000 household per market.

Based on the ARF model, at present, media evaluation is still at Stage II, which is vehicle exposure. Even though clients have access to some meter-measured advertising exposure data, such as A. C. Nielsen's frequency distributions of advertising exposure to a particular brand, the real business of media planning, buying, and selling has gone on at the levels of Stage I and II for the last 35 years. A full complement of advertising exposure data for all types of broadcast and print media should be developed to go beyond vehicle exposure (Chook, 1983).

Four Concepts of Media and Advertising Audience Measurements

In order to further clarify the relationship of vehicle and advertising exposures, it is necessary to know differences among four concepts of media and advertising audience measurements: vehicle audience, vehicle exposure, advertising audience, and advertising exposure. These four concepts represent four dimensions of media and advertising audience measurements. Table 3 below illustrates these four dimensions of media and advertising audience measurements.

Table 3
Four Concepts of Media and Advertising Audience Measurements

Person	Vehicle audience		Vehicle exposures		Advertising audience		Advertising exposures	
	TV	Mag.	TV	Mag.	TV	Mag.	TV	Mag.
A	Yes	Yes	1	1	Yes	Yes	1	1
B	Yes	Yes	1	2	No	No	0	0
C	Yes	Yes	1	4	Yes	Yes	1	2
D	Yes	Yes	1	3	No	No	0	0
E	Yes	Yes	1	1	Yes	Yes	1	3
Total	5	5	5	11	3	3	3	6

As presented in Table 3, among all five persons who saw or read a vehicle, only three were exposed to the advertising message. That is, the number of advertising audience is three and smaller than that of vehicle audience which is five.

In the case of television, the size of the vehicle and advertising audience are the same as those of vehicle and advertising exposure, respectively, while in the case of magazine, the numbers of vehicle exposures and advertising exposures are bigger than

those of vehicle and advertising audience. This is because print media such as magazines and newspapers can be read repeatedly unless they are thrown away, while a television program can not be seen again unless it is recorded by Video Cassette Recorder (VCR). The following example in Table 4 explains these four dimensions of advertising measurements using more specific media terminologies.

Table 4
Dimensions of Four Concepts of Media and Advertising Audience Measurements

Television	# of Audience	Magazine	# of Audience
Program audience	10 million	Issue audience	10 million
Program exposures	10 million	Issue exposures	30 million
Commercial audience	8 million	Ad-Page audience	8 million
Commercial exposure	8 million	Ad-Page exposures	20 million

As presented in Table 4, television vehicle audience which is called "program audience" is the same as program exposures, while magazine vehicle audience which is called "issue audience" is smaller than issue exposures. The program audience and program exposures are bigger than the commercial audience and commercial exposures, respectively, while the issue audience and issue exposures are bigger than the ad-page audience and ad-page exposures, respectively. Thus not only are there differences between four concepts of media advertising audience measurements, but there are differences between a television and magazines in terms of these four concepts of media and advertising measurements.

Operational Definition of Media Evaluation

Media evaluation must be defined operationally as it is used as a key term in this study. In general, the operational definition of media evaluation must include two elements: the specification of the subject of evaluation and the specification of the means of evaluation.

In a broad sense, the subject of media evaluation means a media plan. The media plan is composed of several components such as the media objectives, media strategies, media tactics, and media advertising schedule. Therefore, the subject of media evaluation might include one, several, or all of these components of the media plan. The specific subject of media evaluation in this study points to the network television advertising schedule which is composed of different numbers of programs and insertions. A media advertising schedule is the end result of media planning and ultimately aims at achieving media, advertising, and marketing objectives by delivering an ad to the target audience.

Media evaluation requires a certain criteria or means of evaluating a media plan. The criteria or means of media evaluation is the measure of "effectiveness" which indicates "the degree to which a media plan contributes optimally to the success of advertising and marketing objectives" (Sissors & Goodrich, 1990, p. 203). These criteria or means can be either qualitative or quantitative. There are three categories of media evaluation criteria. They are creative, audience and management factors. "Creative factors determine the impact and potency of messages delivered by a medium. Audience factors are related to a medium's ability to deliver messages to selected audiences in a timely manner. These audience factors include reach, average frequency, effective reach, and exposure distributions, which are so-called media

evaluation factors. Management factors are related to production and cost efficiency" (Adler, 1989, p. 155).

The focus of this study is on evaluating the impact of network television advertising schedules on the target audience in terms quantitative media evaluation criteria such as reach, frequency, effective reach, gross rating points (GRPs), and exposure distributions. To reach as many in the target audience as possible with an adequate number of impressions within a limited time frame and budget has been the primary goal of many media plans, which ultimately aim at accomplishing advertising and marketing goals.

Therefore, the subject and means of media evaluation with which this study deals are network television advertising schedules and media evaluation factors such as reach, frequency, gross rating points (GRPs), effective reach, and exposure distributions.

In summary, the operational definition of media evaluation in this study is expressed as evaluating the likely impact of a network television advertising schedule on the intended target audience in terms of media evaluation factors such as reach, frequency, gross rating points (GRPs), effective reach, and exposure distributions.

Television Media Evaluation Factors

There are several media planning concepts used as criteria to evaluate the effectiveness of television advertising or other media advertising schedules. They are called media evaluation factors such as reach, frequency, exposure distributions, and so on. Since this study deals with evaluating television advertising schedules in terms of these media evaluation factors, it is necessary to know these media planning concepts to

better understand the objectives of this study. American Association of Advertising Agencies (1990) well summarized why these media evaluation factors are necessary in assessing the effectiveness of media advertising schedules.

> "The major audience research sources enable an advertiser to quantify the audience to any single media vehicle. However, since most ad campaigns (or specifically advertising schedules) consist of multiple ads in several vehicles, perhaps in more than one medium, further information is needed to assess cumulative campaign performance. Adding the audiences or ratings of a series of announcements or insertions will provide a gross count of the total audience, but will not specify how many people were exposed to the campaign once, twice, many times, or not at all. In order to obtain this essential information, we must use the statistics known as reach and frequency." (American Association of Advertising Agencies, 1990, p. 14)

These statistics are often called audience exposure patterns and are used to analyze alternative advertising media schedules to determine which produces the best results relative to the media plan's objectives (Surmanek, 1986). The survey of media directors of leading US. -headquartered, multi-national advertising agencies (Lancaster et al., 1986) found that 76.9 percent of the media plans described by respondents include evaluations of reach, frequency, and gross rating points (GRPs) for combinations of two or more media categories. These media evaluation factors are as follows:

Reach

Reach (often referred to as "cume") is the proportion of the population which is exposed at least once to a vehicle or schedule, or the number of different persons exposed to a media vehicle or schedule at least once within a given period of time, generally expressed as a percentage. In other words, it is the sum of the audience sizes of one, or more than one, vehicle or insertion subtracted from the portion of the

duplication (or the n-tuplication in the case of n vehicles). Suppose a magazine schedule is composed of television programs A and B which are watched by 13 and 10 percents of all women, respectively and 4 percent of these women read both A and B. Then reach of this schedule 19 percent. In other words, (13 + 10) - 4 = 19.

In the case of the use of "n" vehicles, the problem to obtain reach becomes geometrically complicated as a function of the number of insertions because of overlap or duplication of exposure on the part of target audience individuals. Therefore, special mathematical formulas, such as the beta binomial distributions (BBD), are needed to estimate the reach of "n" vehicles. In general, "reach increases as ratings and numbers of advertisements increase, but it begins to decline in rate (not total) over time" (Sissors & Surmanek, 1986, p. 68-69).

Frequency

Frequency (often referred to as "average frequency") is the average number of times target members are exposed to a media schedule. The average frequency is obtained by dividing the gross rating points by the audience who will be exposed to the schedule one or more times. For example, if the gross rating points of television programs A, B, and C is 58 percent (20 plus 17 plus 21) and the percent of the audience who are exposed to the schedule one or more times (reach) is 39 percent, then the average frequency is 1.5 (58 divided by 39). This means that the average person reached will be exposed to the schedule 1.5 times. Frequency is emphasized when it is necessary to obtain more affective consumer responses such as attitude change.

"Frequency begins to rise much faster than reach as additional vehicles are added to the schedule because every new vehicle adds only a minuscule amount to

reach and a large amount to frequency" (Sissors & Surmanek, 1986, p. 69). Given the fixed media budget, more frequency can be obtained at the expense of reach, and vice versa, because reach and frequency are inversely related.

Gross Rating Points (GRPs)

Gross rating points (GRPs) is a crude or gross measure of audience expressed as the sum of the rating points delivered by a particular schedule. It is obtained by summing the rating of each vehicle in the schedule. For example, if ratings of magazine vehicles A, B, and C are 30 percent, 40 percent, and 50 percent, the gross rating points are 30 + 40 + 50 = 120. Gross rating points may also be computed by multiplying the reach of a given schedule by the average frequency. That is, GRPs = reach x average frequency. Gross rating points is a measure of the effectiveness of the media schedule because it represents total exposures delivered by the schedule.

Effective Frequency

Effective frequency is the number of advertising exposures needed for a message to have its desired communication effects on individuals. The desired communication effects could be attention, awareness, interest, desire, purchase, and others concerned with the hierarchy of effects.

The concept of effective frequency was initiated by Herbert Krugman in 1972. Based on his "three hit" theory, one or two exposure provide an insufficient base for consumers to learn about the product or message. Three advertising exposures appear to have a stronger effect than one or two, and therefore, may be the optimal advertising

frequency. A threshold effect tends to occur below three exposures which means that below the threshold there will be little or no effect of advertising. The S-shaped response function indicates there is a threshold.

However, there is confusion and controversy over the level of effective frequency. Many direct marketing practitioners have not found the S-shaped curve to occur very often. They noted that, in their marketing or advertising campaigns, the first or second exposure had been able to generate noteworthy response, thereby arguing that most response curves are convex, and are not S-shaped (Sissors & Bumba, 1993).

It is said that the effective frequency may vary in response to a host of other variables, such as consumer involvement with message or product, media used, creative execution, extent of clutter, and specific market or brand conditions (McGann & Russell, 1988; Turk, 1988). For instance, a low involvement product might require more frequency, while high involvement product may require less frequency for an ad message to be effective.

"Recent research has indicated that the most common level of effective frequency used is three or more exposures (3+), followed by four or more (4+), and three to ten (3-10), among others" (Lancaster & Katz, 1988, p. 2-6).

"Additional frequency will result in increases in consumer responses (e.g., recall, recognition, sales, and the like) over as many as twenty exposures" (Russell & Verrill, 1986, p. 137). After three to five exposures, however, the additional increment of consumer responses decreases at a rapid rate (Kleppner, 1986).

Effective Reach

Effective reach is the percentage of the target exposed to an advertising schedule at the level of the effective frequency. The use of the concept of effective reach has been limited because of the problem of the discrepancy between advertising and vehicle exposure. The exposure distribution provides information required to determine the level of effective reach.

Exposure (or Frequency) Distributions

Exposure distribution is the percentage of the target exposed to each frequency level of a schedule. It shows the distribution patterns of reach at each frequency level. The value of the concept of exposure distribution has been demonstrated because it gives more pertinent information than do individual reach and frequency in comparing and evaluating alternative media schedules. Specifically, it prevents an analysis of media schedule alternatives based on individual average frequency from becoming misleading. Suppose that one media schedule (A) produces more average frequency than does another schedule (B). But the schedule (B) delivers more audience members at the effective exposure level (e.g., three exposures) than does the schedule (A). In this case, the schedule B is superior to the schedule A (Surmanek, 1986). The exposure distribution provides all information relevant to reach and frequency such as reach, average frequency, GRPs, and effective reach. The estimation of the exposure distribution is required when the effective reach concept is used as the media objective and criterion.

Cost Per Thousand (CPM)

Cost per thousand (CPM) is a measure of relative cost efficiency of media vehicles or schedules expressed in dollars spent to reach a thousand target audience members. This figure is obtained by dividing the cost of an ad by the size of the audience in thousands. That is, CPM = Media Cost (in dollars)/Target Impressions (in thousand).

Cost Per Point (CPP)

Cost per point (CPP) is the cost of delivering one GRP (one percent of a population group). The most common application for CPPs is during the development of a media plan when they are used to help determine levels of advertising support (American Association of Advertising Agencies, 1987).

Characteristics of Television in the United States

Television has been an integral part of media mixes in the United States. Most national and local advertisers in the United States utilize televisions as a major medium to reach their target audiences.

In the United States, television makes up the second leading advertising medium in total dollar revenue, after newspapers in the United States. It accounts for 22.1 percent of the total compounded media expenditures of $129 billions according to the statistics in 1991. 70.9 percent of $28 billions television media expenditures was spent by national advertisers, while 29.1 percent was spent by local advertisers.

Presently, as many as 1,200 television stations and 9,600 cable systems operate in the United States. Most of 1,200 stations are composed of local affiliates and independent stations. There also are four major commercial television networks: American Broadcasting System (ABC), Columbia Broadcasting System (CBS), National Broadcasting System (NBC), and the Fox Broadcasting Company (FOX). The public television network-Public Broadcasting Service (PBS)-does permit program sponsorship as a means of providing company recognition. Today, 98 percent of all 93 million television households in the United States own a television set.

Television advertising can be best categorized into six types: network, national cable, syndication, national spot, local spot, and non-network cable. "The first four types are used predominately by national advertisers, whereas the latter two are used primarily by local firms" (Jugenheimer et al., 1992, p. 324). More than 70 percent of television dollars are spent by national advertisers, who predominately use network advertising (33.0%) or national spot advertising (27.4%) in the United States.

One major explanation for the use of television as a major advertising medium is its flexibility and mass coverage of audiences. Television is able to reach a variety of consumers from general to highly selective audiences nationally and locally through the availability of network, spot, cable, and syndication programs. Television offers added benefits to advertisers with its dynamic audiovisual demonstrations, along with its cost efficiency and prestige. Its major weaknesses as an advertising medium include high total cost, short-lived messages, no catalog value, and limited availability of good programs and time slots. When buying television advertising time, a buyer should be familiar with the various options and discounts offered such as a "volume" discount and "frequency" discount in order to maximize the effectiveness of inputs.

The Standard Directory of Advertisers lists 17,000 companies engaged in advertising in a typical year. A variety of up-to-date audience information, including data on media and product usage, and demographic, geographic, sociopsychological, and socioeconomic profiles of consumers are available through such companies as A. C. Nielsen Co., Mediamark Research Inc. (MRI), and Simmons Market Research Bureau (SMRB).

Television as an advertising medium would remain very competitive in the near future. In the long term, however, television advertising will face new challenges by the applications of new interactive communication technologies which combine computer, telephone, and television. These interactive applications allow viewers to control the amount and quantity of commercial viewing. Advertisers must find out an entirely different media and creative strategy for capturing consumers' attention to the ad. In addition, these new interactive technologies are expected to sell advertising time through electronic newspapers, computer on-line network systems such as Internet and AT&T Interchange On-line Network, or other computer on-line services such as CompuServe and American On-line. These new advertising tools will eventually reduce the opportunities of television commercials in the future.

Characteristics of Television in Korea

Overview

Network television was primarily chosen for this study because of the availability of message rating data provided by Media Services Korea Inc. (MSK). Television is the second leading medium in terms of total advertising volume, after

newspapers. About $1.04 billion was spent by advertisers on television in 1992, which accounts for 30.4 percent of a total of $3.43 billion media expenditures in Korea. According to the statistics in 1993, 98 percent owned a television set and approximately 50 percent of total households own at least two television sets in Korea.

Buying advertising time is very competitive in Korea because the time slots of television advertising fall short of advertisers' demand. This is because there is no daytime broadcasting in Korea and there are only three major networks which accept commercial advertising: Korean Broadcasting System - 2 (KBS-2), Munhwa Broadcasting Company (MBC), and Seoul Broadcasting System (SBS). 21 cable television channels, however, which took an air in March, 1995, are expected to make up the shortage of commercial time slots.

Dominant product categories using television advertising in Korea include cosmetics, foods, beverages, and other daily commodities such as medicines, cloths, detergents, and electronics.

In 1993, there were as many as 96 advertising companies engaged in advertising activities in Korea. Fifteen major agencies dominate television adverting volume accounting for 70 percent of a total of $3.43 billion media expenditures in Korea. At present, several research companies such as Media Services Korea Inc. (MSK) and A. C. Nielsen Inc. in Korea provide advertisers and agencies with media audience and demographic data.

It is important to note that since the establishment of the Korea Broadcasting Advertising Corporation (KOBACO) in 1981, all broadcast media advertising must be booked through KOBACO. All television commercials must be reviewed and approved by the Korean Broadcasting Commission (KBC) prior to airing.

Television Networks and Coverage in Korea

Since the first broadcasting in 1961, television stations have been expanding rapidly throughout the country. At present, there are five television networks in Korea. Three are publicly-owned: KBS-1TV, KBS-2TV, and KBS-3TV, while two are privately-owned: MBC-TV and SBS-TV. Four networks excluding KBS-3TV, which is the education channel, accept commercial advertising.

Five networks have a total of 77 stations nationwide. Four stations, KBS-1TV, KBS-2TV, KBS-3TV, and MBC-TV, have national coverage, while one station, SBS-TV, covers only the Seoul metropolitan area.

Cable television took the air on March 1, 1995. There are as many as 21 commercial cable channels in Korea. They include music, family, entertainment, and nature channels, among others. They are allowed to sell commercial time slots. Since they do not have considerable number of subscribers at this early stage of cable broadcasting, however, it is not easy to sell all of available commercial time slots.

Table 5 below shows five television networks and their coverage in Korea.

Table 5
Television Networks and Coverage in Korea

Types	Networks	No. of Stations	Coverage
Commercials Network	KBS-1TV	20	Nationwide (96.7%)
	KBS-2TV	20	Nationwide (89.3%)
	MBC-TV	20	Nationwide (91.5%)
	SBS-TV	1	Seoul Area (34.0%)
Non-commercial	KBS-3TV	16	Nationwide (88.1%)

Television Broadcasting Hours and Time Classification

The television day is divided into four major time periods, called dayparts. Four dayparts in Korea are SA Time, A Time, B Time, and C Time. These four dayparts are divided into 22 small time periods. Notably, due to economic reasons in Korea, there is no daytime programming during weekdays from 11 A.M. to 5:30 P.M.

SA Time is the time period in which people watch television programs most. This time period is similar to the primetime in the United States. Program ratings during this time period are generally the highest of the four time periods. Popular SA Time programs include evening soap operas, comedies, and music show.

A Time is similar to such dayparts as the prime access and the first half of the late fringe in the Unites States. This time period is generally located one hour before and after primetime. Television ratings during this daypart are the second highest following SA Time. The popular programs during this time period include news, variety shows, music shows, serials, and comedies.

B Time is close to the early fringe and the second half of late fringe in the United States. Television ratings are the third highest following SA Time and A Time. This daypart includes a variety of programs such as children's programs, news, women's shows, serials, nature, quiz shows, and educational programs.

C Time is the time period in which there are the smallest number of audience members watching television programs. Television ratings and costs are the lowest during this time period. The first- and the last half-hour of the television day are generally included in this daypart. Major programs during this daypart are morning variety shows, music, sports, and a variety of educational programs. Television broadcasting hours and time classification with program types are shown in Table 6.

Table 6
Television Broadcasting Hours and Time Classification with Program Types

TIME	WEEKDAY	TIME	SATURDAY	TIME	SUNDAY
06:00	**C** (variety show)	06:00	**C** (variety show)	06:00	**C** (variety show)
07:00	**B** (variety, news, serial, health, travel)	07:00	**B** (news, serial, women, comedy, movie, childern, sports, music show, music video, cooking)	07:00	**B** (quiz, serial)
10:00	**C** (mostly non-programming or special program)	18:00	**A** (TV magazine show,comedy)	08:00	**A** (children, serial, variety, comedy, movie, sports, news, music show)
17:30	**B** (children, nature, educational, music show)	19:00	**SA** (comedy, serial, variety, movie, music show, news, sports news).	19:00	**SA** (variety, serial, movie, comedy, news, sports news, reality).
19:00	**A** (variety, music show, news)	22:30	**A** (talk show, movie, news)	22:30	**A** (talk show, movie)
20:00	**SA** (comedy, serial, game, mini-series)	23:30	**B** (news, educational)	23:00	**B** (talk show, news)
22:30	**A** (news, sports news)	24:00	**C** (educational)	23:30	**C** (educational, music, sports)
23:00	**B** (music show)	01:00		01:00	
23:30	**C** (educational)				
24:00					
01:00					

Source: the 1993 KOBACO (Korean Broadcasting Advertising Corporation) Report.

Television Commercial Sales Types and Costs

There are five different sales types of commercials based on time slots and kinds of programs. They are program, spot, ID card (identification card), yearly sports, and special program.

Program commercials

Program commercials mean commercials which were bought by the advertiser who participates in the program as a sponsor. Program participation is possible within eight percent of the total program time length. Available commercial lengths are 15, 20, and 30 seconds. Most of program commercials are 15 seconds and sold on a national basis. Television commercials can only be placed either before or after the program, which means there are no mid-program commercial breaks. Three major networks, KBS-2TV, MBC-TV, and SBS-TV, are allowed to sell program commercials.

Spot commercials

Spot commercials are commercials between program breaks. Most spot time is sold locally. Spot commercial length is fixed to 30 seconds. Three 30-second commercial time slots per each break are allowed to be sold. Spot can be sold by four major networks except for KBS-3TV, the educational channel. In case of KBS-1TV, spot time is allowed to be sold block by block on a national basis during Saturday and Sunday only. One block includes ten 30-second commercials. Only three blocks are allowed to be sold on each of Saturday and Sunday.

<u>ID card commercials and sports</u>

The ID card runs on the bottom of the TV screen during station identification breaks. Running time is only 10 seconds. Sports game commercials involve a yearly contract. Korean television commercial time rates are presented in Table 7 below.

Table 7
Korean Television Commercial Time Rates (US $)

Dayparts	KBS-2TV	MBC-TV	*SBS-TV	KBS-1TV
Program (National) Costs per One Second				
SA	51.34	51.55	*4.58	36.96
A	41.86	42.04	*3.73	30.01
B	28.38	28.49	*2.53	20.38
C	13.46	13.51	*1.20	9.68
Spot (Seoul Metropolitan) Costs Per 30 Seconds				
SA	2038.88	2038.88	2038.88	**5816.88
A	1188.00	1188.00	1188.00	**3780.38
B	344.50	344.50	344.50	**1324.13
C	168.13	168.13	168.13	** 595.38

Source: The 1993 KOBACO (Korean Broadcasting Advertising Corporation) Report.
*SBS-TV covers the only Seoul metropolitan area.
**KBS-1TV sells only national commercial time.

Lead Time for Placement

The lead time required to purchase television time is approximately three months. Most spot and program commercials are contracted to run for a minimum of one month.

CHAPTER IV
ESTIMATING VEHICLE AND MESSAGE EXPOSURE DISTRIBUTIONS OF TELEVISION ADVERTISING SCHEDULES

This study first tests hypotheses regarding the differences between vehicle and message exposure distributions. Second, this study develops the regression equation model used to estimate message exposure distributions of network television advertising schedules. Both studies require as input data 508 estimates of vehicle exposure distributions and 508 matching estimates of message exposure distributions obtained from a total of 508 sample Korean television advertising schedules. Before going into the method chapter, it is necessary to discuss the method to obtain these estimates of vehicle and message exposure distributions of 508 Korean television advertising schedules, along with source of vehicle and message ratings used as input data in estimating these vehicle and message exposure distributions of Korean network television advertising schedules.

The author first would like to introduce a variety of media evaluation models (or reach/frequency estimation models) which have been used to estimate exposure distributions of television advertising schedules over thirty years in the advertising industry and academia. Second, the beta binomial distribution with limited information (BBD-L) model, which employed to estimate vehicle and message exposure distributions of television advertising schedules in this study will be introduced, followed by discussions regarding source of vehicle and message rating data.

Media Evaluation Models

A variety of computerized media evaluation models have been developed and used over thirty years in both the advertising industry and academia. They aim at evaluating media advertising schedules by estimating reach, frequency, effective reach, or exposure distributions.

The first pioneering work in model-building research was a simple reach estimation model developed by Agostini in 1962 (Danaher, 1989; Leckenby & Kishi, 1982b). Agostini developed his reach estimation model by curve-fitting methods involving actual duplication audience data for French magazines (Leckenby & Ju, 1990). After that, media evaluation models have advanced in sophistication (Rust, 1986). Most recent models have dealt with the complex issue of the calculation of the exposure (or frequency) distribution by the number of exposures of a given media schedule. Exposure distribution estimation models provide all information relevant to schedule delivery such as reach, average frequency, effective reach, gross rating points (GRPs), and exposure distributions.

Exposure (or frequency) distribution models are divided into two groups in terms of estimation dimensions which include a number of parameters: univariate probability distribution models and multivariate probability distribution models. "Univariate probability distribution models average all vehicles into one univariate, composite vehicle and then treat a schedule of $n(i)$ insertions in each of i vehicles as one vehicle with the sum of $n(i)$ insertions" (Ju et al., 1990, p. 323). Therefore, univariate probability distribution models such as the beta binomial distribution (BBD) require a large amount of audience and duplication averaging which "washes out" peaks and valleys in actual distributions (Leckenby & Kim, 1992).

Univariate probability models have been more popular than multivariate probability models in practice, since they are simple, parsimonious, and guarantee relatively sound estimation compared with multivariate models. More than ten univariate probability distribution models have been developed and published in the marketing and advertising journals over thirty years. The notable univariate probability models are the binomial, beta binomial (BBD), Markov binomial, Morgenzstern, Hofmans geometric distribution (HGD), Kwerel geometric distribution (KGD), and others (Leckenby & Ju, 1990).

Among them, the most popular and heavily used univariate probability distribution model is the beta binomial distribution (BBD) model introduced by Metheringham in 1964. The beta binomial distribution (BBD) model is a statistical procedure for estimating the likelihood of a target member's exposure to a schedule a given number of times. That is, the beta distribution estimates the number of different ways target members can be exposed to the schedule, while the binomial distribution estimates the probability of exposure to the schedule. The product of the beta and binomial distributions is the schedule exposure distribution. (Lancaster & Katz, 1988). It is known that the beta binomial distribution model often yields an over-estimation in reach (Leckenby & Rice, 1985; Leckenby & Kim, 1992).

The beta binomial distribution (BBD) model requires as inputs all three kinds of media audience data such as single-insertion ratings, self-pair ratings, and cross-pair ratings. However, some derivatives of the beta binomial distribution model, which are often called the beta binomial distribution with limited information (BBD-L) model do not require the pair-wise duplication data such as self- or cross-pair ratings. These models estimate the duplication data either using the method of means and zeros (Anscombe, 1950; Leckenby & Rice, 1985), or by the use of regression analysis

(Lancaster & Martin, 1988; Lancaster & Katz, 1988; Headen et al., 1976). The BBD-L models save much time and effort in gathering self- and cross-pair data, which may even be unavailable in many situations (Lancaster and Katz, 1988). Instead of the BBD-L model, such univariate probability distributions as the Poisson binomial distribution tested by Ju in 1991 can be used without duplication data for broadcast audience estimation.

The beta binomial distribution has been used as a basis of estimating the exposure distribution of many other univariate and multivariate models. Univariate variants of the beta binomial distribution (BBD) include BBD-DE, Hofmans BBD, and BBD simulation. The multivariate analog of the BBD is the Dirichlet distribution.

On the other hand, multivariate exposure distribution models provide individual vehicle audience information by preserving as many estimation dimensions (parameters) as there are vehicles in the schedule, as differentiated to univariate models which average them into a "composite" vehicle and then estimating the ensuing distribution. Due to their complexity, multivariate models require more data manipulation and computation time. In return for complexity, however, multivariate models are considered to produce a more accurate estimation than do univariate models (Headen et al., 1976).

Most multivariate models are magazine audience estimation models because true multivariate probability distribution methods that estimate broadcast audiences have not been developed (Leckenby & Kim, 1992). The magazine multivariate probability distribution models include: the multivariate beta binomial (Liebman & Lee, 1974), the first application of a multivariate distribution, Dirichlet multinomial distribution (DMD) (Leckenby & Kishi, 1984; Chandon, 1976), the first true multivariate distribution, Log-Linear model (Danaher, 1988, 1989), Dirichlet multivariate multinomial

distribution (DMMD) (Boyd, 1985; Danaher, 1988, 1989), modified form of log-linear model, and the mixed-media Dirichlet multinomial distribution (Rust & Leone, 1984). Among them, the Dirichlet multinomial distribution (DMD) developed by Chandon and Hofmans BBD is known to be more accurate than any of the others (Leckenby & Ju, 1990).

Considered as modified forms of multivariate probability distribution models are multivariate sequential aggregation models and loglinear approximation models. These models use approximating devices to overcome the "dimension explosion" problem of the true multivariate exposure distribution model. The true multivariate exposure distribution model is rarely implemented without approximating devices for more than seven vehicles as in the case of the Boyd DMMD (Leckenby & Ju, 1990).

A recent review of media reach/frequency models done by Leckenby & Kim (1992) put more emphasis on multivariate distributions than on univariate distributions.

> Multivariate distributions are important to pursue because they allow for the most realistic and complex modeling of the media exposure process without a burdensome number of simplifying or "averaging" assumptions required by univariate probability functions. These simplifying assumptions ordinarily distort the true, complex shape of the exposure distribution. (Leckenby & Kim, 1992, p. 102)

Two major media categories in which these exposure distribution models are developed and used to evaluate media schedules are television and magazines. "Because national advertisers make heavy use of network television and national magazines (and due to the amount of money spent to advertise in these media), most recent work has focused on developing media models for these two media" (Rust et al., 1986, p. 30).

The Beta Binomial Distribution with Limited Information (BBD-L) Model

The beta binomial distribution (BBD) model has been chosen as a mathematical basis to estimate vehicle and message exposure distributions of television advertising schedules in this study because the reliability of this model has been proven over more than two decades (e.g., Ju et al., 1989; Leckenby & Boyd, 1984; and Kishi & Leckenby, 1981).

Due to the lack of pair-wise message duplication data such as message self- and cross-pair ratings, this study will use the BBD-L model which does not require pair-wise duplication data. This model developed by Lancaster and Martin in 1988 estimates pairwise-duplication data using two regression equations: self- and cross-pair estimating equations. Lancaster and Martin created these self- and cross-pair estimating equations by fitting the regression curves into actual duplication data obtained from SMRB.

These two estimating equations turned out to be very accurate in predicting self- and cross-pair ratings of television programs when the test results were compared with the actual self- and cross-pair audience ratings reported by SMRB. The mathematical form of the BBD-L model is expressed as follows (Lancaster, 1993, p. 152-155):

$$V_{f=0} = \prod_{f=0}^{N-1}(B+f)/(A+B+f) \quad (1)$$

$$V_{f>0} = ({}_{N}C_{f})(V_{f-1})(A+f-1)(B+N-f) \quad (2)$$

where V = probability of exposure f times to the vehicles in a schedule

f = particular exposure number where $f = 0$ to N total insertions in the schedule

A = exposure parameter = $[\bar{R}_1(\bar{R}_2 - \bar{R}_1)]/[2\bar{R}_1 - \bar{R}_2 - (\bar{R}_1)^2]$

B = non-exposure parameter = $[A(1 - \bar{R}_1)]/\bar{R}_1$

N = total insertions in the schedule

$\bar{R}_1$ = average single insertion rating = $\sum_{i=1}^{m} n_i R_i / \sum_{i=1}^{m} n_i$

$\bar{R}_2$ = average pair-wise rating = $[(\sum_{i=1}^{m}(n_i C_2)R_{2i}) + (\sum_{i=1}^{m-1}\sum_{j=i+1}^{m} n_i n_j R_{ij})]/({}_N C_2)$

m = total number of vehicles in the schedule

n_i = number of insertions in vehicle *i*

R_i = audience rating of vehicle *i* (single-insertion or one-time rating)

R_{2i} = two-insertion rating of vehicle *i* (self-pair rating)

$= K_w + (1.7946)(R_i) - (1.3308)(R_i)^2$. where, $K_w = 0$ for cable television, -.0065 otherwise

R_{ij} = rating of one insertion in each of vehicles *i* and *j* (cross-pair rating)

$= K_b + (1.0095)(R_i + R_j) - (1.5012)(R_i)(R_j)$. where, $K_b = 0$ for cable television, -.0015 otherwise

C = combination formula (e.g., in order of appearance, *N* total schedule insertions taken *f* at a time, n_i vehicle insertions taken two at a time, *N* total insertions taken two at a time)

Source of Vehicle and Message Ratings

Vehicle Ratings

Vehicle rating is defined as the size of an audience for a radio, TV, or cable program, expressed as a percentage of a complete population group in a particular

market area. Several syndicated research services such as A. C. Nielsen, Mediamark Research Inc. (MRI), and Simmons Market Research Bureau (SMRB) provide media planners, advertisers, media companies, and educators with vehicle rating data.

There are four types of vehicle ratings reported by major syndicated media audience research companies. The first is "the average audience," which is the rating during the average minute of programming. This is the most widely used measure in national network activities. "Meter-generated and coincidental telephone survey ratings are reported as average audience ratings " (Beville, 1988, p. 311). This type of ratings are provided by A. C. Nielsen Inc., and Information Resources Inc. (IRS). The second type of rating is "the average half hour audience" which is the rating during the average 30 minutes of programming. This type of rating is reported by such companies as Simmons Research Bureau (SMRB) and Mediamark Research Inc. (MRI), which primarily use diary surveys in collecting the media audience data. The third type of rating is "the average quarter hour rating" which is the rating in a given quarter hour. This is primarily a product of diary surveys because diaries are usually recorded every 15 or 30 minutes. The fourth type of rating is "total audience" which is the number of households that tune, view, or listen to a program for five minutes or more of its duration. This measure is used primarily to report audiences for long-form or multi episode programs.

Four of the most widely used methods of collecting media vehicle audience data are diary, telephone survey, personal interview, and electronic meter such as the peoplemeter. Nielsen and Information Resources Inc. (IRI) use peoplemeters, while Simmons Market Research Bureau (SMRB) and Mediamark Research Inc. (MRI) use a two-week diary and a personal interview to measure television audience viewing, respectively.

Peoplemeters are electronic devices to provide a minute-by-minute record of program viewing and audience demographics, while a dairy is a record maintained by respondents to keep track of their media usage during a certain time period (usually two weeks). Both methods have pros and cons in their methodologies. Peoplemeters can substantially reduce sampling bias, are easy to use, report the data right after audience television viewing, and eliminate memory and illiteracy problems, while the diary is not expensive and provides many demographic breakdowns and household data. The major drawback of peoplemeters is that this device neither measures the presence of viewers in a room nor shows the activities of viewers during commercial breaks. Button pushing fatigue also prevents viewers from keeping records when they leave the room for short periods. One major drawback of the diary is that it relies on a respondent's memory and is subject to the errors of such memory.

Message Ratings

Message rating is defined as the size of an audience for a commercial, expressed as a percentage of the total audience possible in a particular market area.

Currently message ratings are not available to media practitioners. However, several syndicated research services measure advertising exposures (not exactly message rating data) using peoplemeters to meet their marketing purposes. Information Resources Inc. (IRI) estimates advertising exposures for a particular brand to produce "single source data" which combines advertising exposure data with the product purchasing data for 3,000 households per market. A. C. Nielsen also measures the count of advertising exposures of a particular brand to estimate frequency distributions of advertising exposures of that brand. These companies utilize peoplemeters which

are capable of keeping track of viewers' set usage and the channel tuned to on a minute-by-minute basis. Even though peoplemeters are capable of measuring advertising exposures, however, there are many methodological weaknesses. For example, these peoplemeters cannot detect whether viewers pay attention to a comercial during during commercial breaks.

It is believed that accurate estimates of commercial audiences will only be possible with the use of "totally passive" peoplemeters. One of these future techniques, which is called "a computerized image recognition system," is being developed and is being tested in the market by such companies as A. C. Nielsen. This system stores viewers' facial and body image into a computerized memory. By scanning viewers' faces and comparing the objects with its memory to identify who is watching (e.g., family members or visitors), this device recognizes and makes records of when viewers are actually watching the screen and when they look away, fall asleep or leave the room (Webster & Lichty, 1991). This system can overcome the shortcomings of current peoplemeters by passively measuring not only audience presence in the room, but who is watching or if that person is watching or paying attention to the program or commercial.

Some media practitioners and researchers utilize the measurements of communication effects such as recall and recognition scores as the alternatives to advertising exposures. They often use these data on communication effects as weights to adjust vehicle audiences. However, it should be clarified that these recall and recognition scores are the measures of perception to the advertising, not exposure to the advertising because they are originally developed to evaluate the effectiveness of advertising copy. It is known that advertising perception is different from advertising exposure. Advertising perception means that the individual saw, heard, or understood

the advertising message, while advertising exposure means simply that an individual is exposed to the "ad space." For this reason, exposures to the advertisement might not subsequently result in the equivalent number for recall or recognition.

Factors that affect message ratings

Since television programs deliver an advertising message, a program is the most influential factor to message ratings. That is, a higher rated program delivers a larger number of advertising audiences (or exposures). Besides programs, however, many other factors also influence message ratings. They are broadcasting time periods (e.g., primetime vs. fringe), the position of ads within programs, commercial length, program types, the product class involved, an individual's attitude toward a product, whether he or she is close to a purchase, and other creative factors such as emotional appeal, immediacy, and message complexity.

Broadcasting time periods and positions of ads might be the most influential factors among them. According to the SMRB's study, attention to ads is the greatest during late fringe (7-9 PM) and prime time (8-9 PM), while it is the poorest in early fringe and early morning. Also, in-program commercials do a better job in recall of messages than between-program commercials. Program types such as mysteries and spy adventure programs deliver more advertising audiences (or exposures) than variety shows and western programs in message recall. Regarding commercial length, a study conducted by Kim in 1990 found that there was no significant difference between the 15-second commercial and the 30-second commercial in terms of recall and recognition regardless of repetition and clutter (Kim, 1990).

Korean Vehicle and Message Rating Data

The beta binomial distribution with limited information (BBD-L) model used to estimate vehicle and message exposure distributions of 508 sample network television advertising schedules requires as input data the size of the target audience, vehicle and message ratings, and program costs. Korean television vehicle and message ratings and program costs were employed as input data used to estimate vehicle and message exposure distributions of sample network television advertising schedules.

While vehicle costs (i.e., program costs) data were obtained from the Korean Broadcasting Advertising Corporation (KOBACO), Korean television vehicle and message ratings were provided by Media Services Korea Inc. (MSK).

Media Services Korea Inc. (MSK) selected and used A total sample of 275 Korean households in the Seoul metropolitan area to obtain Korean vehicle and message ratings. The sample size accounts for approximately 1,000 individuals who are four or more years old living within the Seoul metropolitan area. The sample was selected based on a multi-stage stratified area probability sampling design. Approximately 20-22 percent of total respondents are annually replaced to keep sample fresh.

Korean vehicle and message ratings were obtained from four one-week periods in 1993: February 1 - 7, June 7 - 13, September 13 - 19, and November 22 - 28. These four periods represent four seasons, respectively: Spring, Summer, Fall, and Winter. Table 8 presents sampling procedures and types of Korean vehicle and message ratings.

Table 8
Periods, Stations, and Types of Vehicle and Message Ratings

Periods Selected	Stations	Types of Ratings
Feb. 1 - 7, 1993	KBS1, KBS2, MBC, SBS	Vehicle, Network, Spot
Jun. 7 - 13, 1993	KBS1, KBS2, MBC, SBS	Vehicle, Network, Spot
Sept. 13 - 19, 1993	KBS1, KBS2, MBC, SBS	Vehicle, Network, Spot
Nov. 22 - 28, 1993	KBS1, KBS2, MBC, SBS	Vehicle, Network, Spot

Total sample size: 275 Korean households including approximately 1,000 target members who are four or more years old living in the Seoul metropolitan area

The AGB peoplemeter 4900 system

MSK employed the "AGB (Audits of Great Britain) peoplemeter 4900" system to measure television viewing and audience demographics of 275 households in Korea.

The AGB peoplemeter system is currently used in 15 out of 33 countries reporting television audience measurements around the world. Among them are ten Asian countries. A total of 380 peoplemeters were installed in 275 sample households in the Seoul metropolitan area.

The AGB peoplemeter system can handle up to eight family members and seven guest viewers. All units operate on normal household electric circuits or telephone lines. The AGB peoplemeter system is also capable of measuring VCRs, cable television, and satellite broadcasting systems.

The AGB peoplemeter system is composed of four units: handset, sensory device, MDU (monitor and display unit), and CDUS (control data storage unit). The

handset is a remote control unit to be used by respondents to provide demographic data of viewership. Every member of the sample household is assigned a number that corresponds to a push button on the handset and they are required to press their button when they begin or stop viewing, thereby indicating their presence to the meter. It uses infrared or ultrasonic signals to avoid interference with the TV set remote controls. The sensory device is an electronic device attached to television tuner and measures when the set is turned on and which channel is viewed on a minute-by-minute basis. The MDU is a device that is placed on top of a television set to record and store demographic information retrieved by the handset. The CDSU is a device that stores the data retrieved by MDU and the sensory device to send data to the MSK central control computer for further analysis.

Telescope and PCTIPS software

Once the raw data are retrieved by AGB peoplemeter over telephone lines on a minute-by-minute basis, software called "telescope" and "PCTIPS" are used to analyze the data to form the final data base.

PCTIPS is software that inspects the raw data and screens out biased and unqualified data from the raw data. Telescope is software that analyzes data in ways desired by clients. Both software can be run by personal computers with Intel 286, 386, 486, and pentium micro processors.

Characteristics of Korean vehicle and message ratings

The vehicle ratings used in this study are "person ratings" during a specific time period, not "household ratings." Person ratings are obtained by dividing the number of viewers by the total number of target members.

Message ratings are "average commercial ratings" which are the percentages of audience members exposed to an average 15-second-commercial. Message ratings are divided into network message and spot message ratings. Network message ratings are the percentages of audience members exposed to an average commercial within network programs, while spot message ratings are the percentages of audience members exposed to average commercial between television programs. A total of 126 Korean television vehicle and message ratings was obtained and utilized to estimate vehicle and message exposure distributions of a total sample of 508 network television advertising schedules.

Table 9

Mean and Standard Deviation of Korean Vehicle and Message Ratings (N=184)

Dayparts	Vehicle		Network Message		Spot Message		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SA	9.28 (9)	2.96	6.72 (9)	2.41	5.64 (9)	2.52	7.19 (27)	2.93
A	7.40 (18)	2.44	5.01 (18)	1.48	4.56 (18)	1.20	5.66 (54)	2.16
B	3.97 (19)	1.58	3.32 (19)	1.51	2.99 (17)	1.57	3.44 (55)	1.58
C	1.23 (17)	1.18	1.32 (17)	0.90	1.50 (14)	1.09	1.34 (48)	1.05
Total	4.97 (63)	3.52	3.75 (63)	2.38	3.53 (58)	2.10	4.10 (184)	2.81

Note: the number of ratings in parentheses

As presented in Table 9 above, the means of vehicle, network message, and spot message ratings are 4.97, 3.78, and 3.52 percent, respectively, which indicates that vehicle ratings are the highest of the three types of ratings, followed by network

message and spot message ratings. The standard deviations of these three types of ratings are 3.52, 2.45, and 2.1 percent, respectively. There are also differences in all types of ratings among four dayparts: SA Time, A Time, B Time, and C Time. As expected, SA Time, which is the same as the primetime period, has highest ratings (7.19 percent), followed by A Time (5.66 percent), B Time (3.44 percent), and C Time (1.35 percent). A complete data base including all of the vehicle ratings and program and spot message ratings is presented in Appendix A.

Two-way ANOVA was also performed to test whether there are statistically significant differences among not only these three types of ratings, but among ratings in four main dayparts such as SA Time, A Time, B Time, and C Time. The results presented in Table 10 below show that not only do statistically significant differences exist among three types of ratings and in ratings among four dayparts, but there are interaction effects between dayparts and types of ratings. Interaction effects indicate that both dayparts and types of ratings affect differences in ratings.

Table 10
Two-way ANOVA Source Table (N=179)

Source	Sum of square	df	Mean sq.	F	p
Between					
Types of ratings	99.33	2	49.66	16.59*	0.000
Dayparts	776.28	3	258.76	86.46*	0.000
Interaction					
Types by dayparts	69.91	6	11.65	3.89*	0.001
Error	499.81	167	2.99		
Total	1445.33	178	8.12		

* indicates .01 level of significance

Relationship Between Vehicle and Message Ratings

The differences between vehicle and message ratings are starting points of this study. It is said that there are differences between vehicle and message ratings due to the tendency for some audience members not to watch commercials during commercial breaks. Based on the analysis of Korean vehicle and message rating data, vehicle ratings are different from message ratings such as network message ratings and spot message ratings. Not only do the differences between vehicle and message ratings vary across four networks and 22 time periods, but the ratios of message to vehicle ratings vary across these networks and 22 time periods.

Vehicle ratings are generally bigger than network and spot message ratings across various time periods. Interestingly, however, message ratings are bigger than vehicle ratings for several of C Time programs. One major reason why some of message ratings are higher than matching vehicle ratings during C Time is that people are usually unable to watch the entire program in the early morning or in the late night. Viewers normally have to go to work as soon as they get up or go to bed early before too late. However, this tendency has not significantly affected the overall results of this study because vehicle and message ratings during C Time are relatively low (the average rating during C Time is 1.15 percent).

The average ratios of message to vehicle ratings of SA Time, A Time, B Time, and C Time are 120, 130, 130, and 120, respectively. As expected, the ratio of message to vehicle ratings during C Time is more than 100, which means message ratings are bigger than vehicle ratings, because of the tendency not to watch the whole program. Figure 2 shows the differences between vehicle and network and spot message ratings.

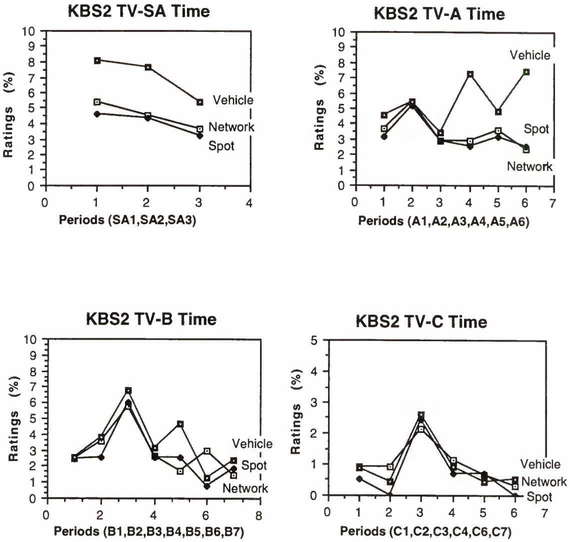

Figure 2. Differences Between Vehicle and Network and Spot Message Ratings

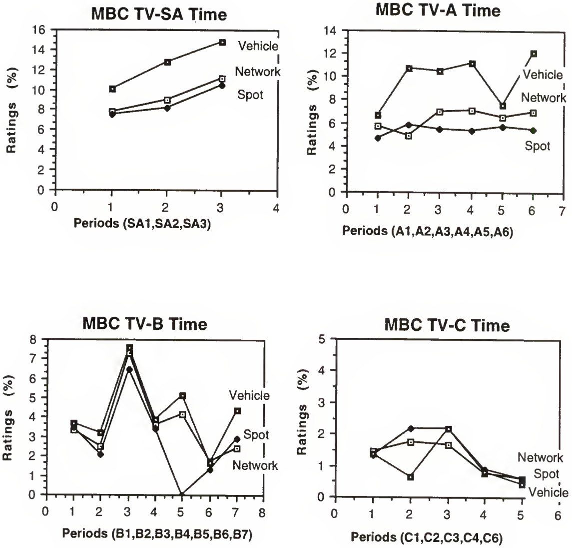

Figure 2- Continued

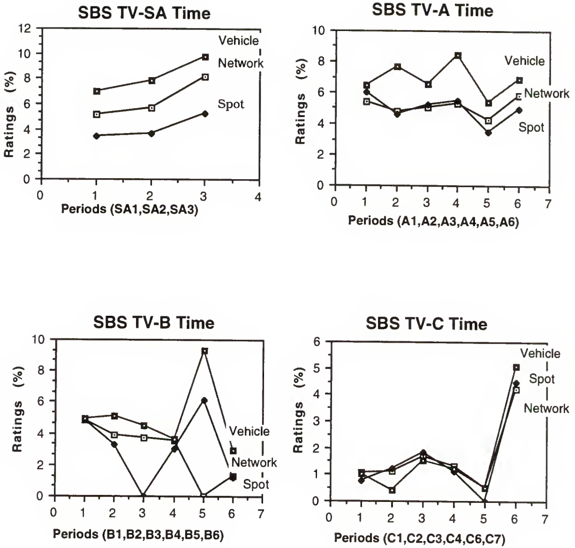

Figure 2- Continued

The findings, which are that vehicle ratings are generally bigger than message ratings, are consistent with the results of previous studies. It is acknowledged that the differences between vehicle and message ratings could vary due to audience members' different viewing habits during different time periods.

CHAPTER V
METHOD

The issue of the discrepancy between vehicle exposure versus advertising exposure on the evaluation of television advertising schedules has been important in developing the media planning theory and practice. The focus of many researchers, educators, and practitioners has been on 1) how the discrepancy between vehicle and advertising exposures inherent in syndicated media audience research data influences the effectiveness of media planning and 2) how to estimate advertising message audiences of television advertising schedules to accurately evaluate the impact of the schedules on the target audience in terms of advertising exposure. This dissertation research attempted to tackle both problems through hypothesis testing and the development of the regression equation model for estimating message exposure distributions of network television advertising schedules.

The method chapter first describes the sampling procedures. Second, it illustrates the tests of research hypotheses including three research hypotheses and testing procedures. Third, this chapter deals with the procedures for developing the regression equation model which is used to predict message exposure distributions of network television advertising schedules as a function of vehicle exposure distributions and other schedules characteristics such as vehicle gross rating points (vehicle GRPs), frequency levels, and the number of insertions and programs.

Sampling

One sample size was utilized to carry out two objectives of this study: the tests of research hypotheses and the development of the regression equation model. The sample size was determined using traditional statistical methods for simple random samples instead of using rules of thumb. Three pieces of statistical information are required to compute the sample size required. The following is the sample size determination formula composed of three pieces of information. They are

$$n = \frac{Z^2S^2}{E^2} \tag{3}$$

where n = Sample size

Z = Level of confidence expressed in standard errors

S = Sample standard deviation

E = Acceptable amount of sampling error

A small scale pilot survey of the population was conducted to calculate the sample standard deviation (S) for a dependent variable which is variation in vehicle and message exposure distributions. Thirty schedules were randomly selected to calculate this sample standard deviation. The estimates of the sample standard deviation (S) of variation obtained from 30 television advertising schedules was 2.3. The confidence interval of 95 percent was used in this study because a high degree of accuracy is needed in the developing the regression equation model. The *Z* value indicating 95 percent confidence interval is 1.96. Concerning the question of what value to insert into the formula for *E*, 0.2 percent was used as an acceptable amount of sample error.

Table 11
Characteristics of Sample Television Advertising Schedules (N=508)

A. Gross Rating Points

GRP Range of Schedules	Number of Schedules	Percent
Less than 100	74	14.6
101-200	93	18.3
201-300	101	19.9
301-400	74	14.6
401-500	82	16.1
500+	84	16.5
Total	508	100.0

B. Number of Insertions (Schedule Intensity)

Number of Insertions	Number of Schedules	Percent
1-10	37	7.3
11-20	57	11.2
21-30	55	10.8
31-40	56	11.0
41-50	60	11.8
51-60	47	9.3
61-70	45	8.9
71-80	52	10.2
81-90	39	7.7
91-100	34	6.7
100+	26	5.1
Total	508	100.0

C. Number of Programs

Number of Programs	Number of Schedules	Percent
1-5	48	9.4
6-10	109	21.5
11-15	119	23.4
16-20	84	16.5
21-25	42	8.3
26-30	36	7.1
31-35	37	7.3
36-40	19	3.7
41+	14	2.8
Total	508	100.0

After analyzing three pieces of information, the sample size needed to carry out two objectives of this study was a total of 508 schedules.

A computer basic program was created and used to randomly select a variety of 508 schedules out of an enormous number of possible options of television advertising schedules.

Television advertising schedules used in a variety of marketing situations differ by their level of gross audience and duplication as well as by the number of vehicles and insertions. A total of 508 randomly selected schedules varied in terms of intensity of the schedule as measured by the gross rating points (GRPs), number of programs, and number of insertions. The characteristics of selected sample schedules are illustrated in Table 11 above.

The Tests of Research Hypotheses

Purposes

The tendency for some audience members not to watch commercials or to be engaged in other activities during commercial breaks has been a major concern of many media planners. These audience viewing habits have led many media planners to wondering whether using vehicle ratings in the estimation of reach and frequency or exposure distributions of a television advertising schedule might result in the wrong evaluation of the schedule's impact on the target audience.

In the introduction chapter, various strategic problems resulting from the discrepancy between vehicle and advertising exposures inherent in vehicle ratings when a television advertising schedule is evaluated in terms of media evaluation factors were

addressed. One problem was the overestimation of message reach, which means that the percentage of message audience members of a particular television advertising schedule, for example, might be lower than that of vehicle audience members of the schedule. The other problem was that this discrepancy between vehicle and advertising exposures could make it difficult to determine the optimal frequency level needed to achieve a particular message effective reach goal, thereby it could limit the use of the effective frequency and reach concepts. Clearly the discrepancy between vehicle and advertising exposures has to do with these potential estimation errors or bias, which further leads media planners to the wrong evaluation of the impact of a television advertising schedule on the target audience.

Despite the significance of the issue of the discrepancy between vehicle and advertising exposures underlying evaluating the impact of a television advertising schedule on the target audience in terms of media evaluation factors, there is little empirical evidence on this issue primarily due to the lack of message data such as message ratings and duplication data available to substantiate the assumptions regarding the issue.

This study will empirically examine whether there are differences between vehicle and message exposure distributions of network television advertising schedules. Research on the differences between vehicle and message exposure distributions could shed light on the question of whether the discrepancy between vehicle and advertising exposures results in the erroneous estimation of true media evaluation factors such as message reach and frequency, message effective reach, and message exposure distributions. These potential estimation errors could lead media planners to the wrong evaluation of the impact of a television advertising schedule on the target audience.

Concerning the research question on the differences between vehicle and message exposure distributions of network television advertising schedules, three fundamental hypotheses come to mind. The first hypothesis is concerned with an equality of vehicle and message exposure distributions, while the second and third hypotheses concern the direction of the differences between vehicle and message exposure distributions. Three hypotheses, which were formulated regarding this research question, are as follows.

Research Hypotheses

Equality of vehicle and message exposure distributions

The first hypothesis is concerned with whether there are statistically significant differences between the vehicle and message exposure distributions. The vehicle exposure distributions are estimates of vehicle exposure distributions obtained from 508 sample network television advertising schedules, while the message exposure distributions are estimates of message exposure distributions of the schedules. Exposure distributions can be expressed as a functional form that includes dependent and independent variables defined as the percent of the target audience and frequency levels, respectively. If differences exist between the two exposure distributions with respect to the relationship between the percent of the target audience at various frequency levels, it would be misleading to use vehicle exposure distributions of a particular television advertising schedule as a proxy of message exposure distributions of the schedule. The first hypothesis is as follows:

Hypothesis 1. Between the vehicle and the message exposure distributions, statistically significant differences exist with respect to the relationship between the percent of the target audience at each frequency level.

Direction of differences between vehicle and message exposure distribution curves

Not only are media planners and researchers interested in an equality of the vehicle and message exposure distributions, but they are also interested in the intercept and the slope of the vehicle and message exposure distribution curves. The vehicle and message exposure distribution curves are the plotted forms of the vehicle and message exposure distributions. The X-axis on the graph represents frequency levels ranging from one to ten, while the Y-axis on the graph represents the percent of the target audience at each frequency level.

It is generally assumed that the intercept and the slope of the vehicle exposure distribution curve are different from those of the message exposure distribution curve. This is because the size of the message audience of a particular schedule is usually smaller than that of the vehicle audience of that schedule.

Given the fact that message ratings are generally smaller than vehicle ratings, it is assumed that the intercept of the message exposure distribution curve is lower than that of the vehicle exposure distribution curve. It is also expected that the message exposure distribution curve has a steeper slope than the vehicle exposure distribution curve. Clearly if the gross rating points (GRPs) of a particular television advertising schedule increase, the vehicle and message exposure distribution curves tend to flatten because more audience members are exposed to higher frequency levels. This tendency supports the fact that the message exposure distribution curve is steeper than the vehicle

exposure distribution curve because message gross rating points (GRPs) are generally smaller than vehicle gross rating points (GRPs).

If the above reasoning is correct, Hypothesis 2 and 3 below should be accepted.

Hypothesis 2. The intercept of the exposure distribution curve will differ for the vehicle and the message exposure distributions.

Hypothesis 3. The slope of the exposure distribution curve will differ for the vehicle and the message exposure distributions.

Testing Procedures

Whether there are statistically significant differences between the vehicle and message exposure distributions of 508 sample network television advertising schedules was determined using the F-test.

The F-test of the equality of the vehicle and message exposure distributions is based on the comparison of the combined error sums of square for both vehicle and message exposure distribution regressions (ESS_c), the vehicle and message exposure distribution models (see Equations 4 and 5 below) with the error sums of square for the pooled vehicle and message exposure distribution regression (ESS_p), the pooled exposure distribution model (see Equation 6). ESS_c and ESS_m should differ by a large amount if there are statistically significant differences between the vehicle and message exposure distributions with respect to the relationship between the percent of the target audience at each frequency level. In other words, if there are small differences between

the vehicle and message exposure distributions, ESS_c and ESS_p would differ by only a non-significant amount.

Both ESS_c and ESS_p were obtained by a regression of 508 estimates of vehicle exposure distributions and 508 matching estimates of message exposure distributions to yield three regression equations: (1) the vehicle exposure distribution equation, (2) the message exposure distribution equation, and (3) the pooled vehicle and message exposure distribution equation.

The author conducted a pilot study of 50 sample network advertising schedules to determine a functional form of regression equation for the vehicle and message exposure distributions. As a result of a regression of a total of 100 estimates of pooled vehicle and message exposure distributions generated from these 50 schedules, the polynomial function with fourth order turned out to be the best functional form of regression equation accounting for the shape of the vehicle, message, and pooled exposure distributions. Its R square, .844, is the highest among various functional forms, indicating 84.4 percent of the variation in the pooled vehicle and message exposure distribution measurements can be explained by this polynomial with fourth order regression equation. Therefore, a polynomial regression analysis with fourth order was utilized to estimate the three regression equations for the vehicle, message, and pooled exposure distributions of 508 sample network television advertising schedules.

The basic deterministic forms of a polynomial regression model with fourth order used in estimating the vehicle, message, and pooled exposure distribution equations in this study are as follows:

$$Y_{vi} = b_0 + b_1F + b_2F^2 + b_3F^3 + b_4F^4 + e_i \quad (4)$$

$$Y_{mi} = b_0 + b_1F + b_2F^2 + b_3F^3 + b_4F^4 + e_i \quad (5)$$

$$Y_{vmj} = b_0 + b_1F + b_2F^2 + b_3F^3 + b_4F^4 + e_i \quad (6)$$

where Y_{vi} = the percent of the target audience exposed to vehicles (v),

Y_{mi} = the percent of the target audience exposed to commercial message (m),

Y_{vmj} = the percent of the target audience exposed to either vehicle (v) or commercial message (m)

i = observation number, where i = 1 to 5,040. Either 508 vehicle or 508 message exposure distributions with approximately 10 cells each includes a total of 5,040 observations.

j = observation number in the pooled regression analysis, where j = 1 to 10,080. This is the combination of 5,040 observations within 508 vehicle exposure distributions and 5,040 observations within 508 matching message exposure distributions.

b_0 = intercept or estimated constant,

b_1, b_2, b_3, b_4 = estimated slopes or regression coefficients,

F = frequency level ranging from 1 to 10.

e_i = error or disturbance term with a mean of zero and normally distributed.

To test Hypothesis 1, the overall F ratio should be computed using ESS_c with ESS_p. The formula below used to calculate the F ratio is presented by Kelejian and Oates (1974). The null hypothesis is accepted or rejected on the basis of the magnitude

of the ratio in the formula. For example, if the calculated F value is bigger than the critical F value with d and $n\text{-}k\text{-}1$ degrees of freedom, $F_{d,\, n-k-1}$, the null hypothesis is rejected, or vice versa. This $F_{d,\, n-k-1}$ can be obtained from any standard table of the F distribution.

$$F = \frac{ESS_c - ESS_p/d}{ESS_p/(n-k-1)} \tag{7}$$

where ESS_c = the combined error sums of square for the vehicle and the message exposure distribution equations.

ESS_p = the error sums of square for the equation based on pooled sample of vehicle and message exposure distributions.

d = the difference in the number of parameters among the regression equations.

n = the total number of observations (cases analyzed in this study).

k = the number of independent variables (parameters)

To test Hypothesis 2, which suggests that there are differences in the intercept between the vehicle and message exposure distribution curves, the paired sample t-test was conducted. In addition, frequency tests will be conducted to show whether the intercepts of the vehicle exposure distribution curves are bigger than those of the message exposure distribution curves, and vice versa.

Hypothesis 3, which is that there are statistically significant differences in the slope between the vehicle and message exposure distributions, was tested by using the same formula presented in Equation 7. Two equations to be compared in Hypothesis

III are the vehicle and message exposure distribution regression equations. The formula including these two equations is as follows:

$$F = \frac{ESS_m - ESS_v/d}{ESS_v/(n-k-1)} \tag{8}$$

where ESS_m = the error sums of square for the message exposure distribution equation.

ESS_v = the error sums of square for the vehicle exposure distribution equation.

d = the difference in the number of parameters between the two regression equations.

n = the total number of observations (cases analyzed in this study).

k = the number of independent variables (parameters)

The overall F ratio should be computed using the error sums of square for the vehicle exposure distribution regression equation (ESS_v) with the error sums of square for the message exposure distribution regression equation (ESS_m). The error sums of square for the vehicle exposure distribution and the error sums of square for the message exposure distribution should differ by a large amount if there are statistically significant differences in the slope between the vehicle and message exposure distributions.

In other words, if the calculated *F* value is bigger than the critical *F* value with *d* and *n-k-1* degrees of freedom, $F_{d,\,n-k-1}$, the null hypothesis, which is that there is no difference in regression coefficients between the vehicle and message exposure distribution equations, is rejected, or vice versa.

The Development of the Regression Equation Model for Estimating Message Exposure Distributions of Network Television Advertising Schedules

Purposes

In the introduction chapter, a value has been demonstrated for advertising exposure relative to vehicle exposure on the evaluation of television schedules. Due to the discrepancy between vehicle and advertising exposures, using syndicated media audience research data such as vehicle ratings and duplication data in the estimation of media evaluation factors could result in the erroneous estimation of the actual media evaluation factors such as message each, message frequency, and message exposure distributions. This erroneous estimation prevents media planners from selecting the optimal schedule which delivers an advertising message to the extent that media, advertising, and marketing objectives are achieved.

To overcome these strategic problems resulting from the discrepancy between vehicle and advertising exposures inherent in syndicated media audience research data and to accurately estimate the impact of television advertising schedules on the target audience, various methods of estimating such audience exposure patterns as message reach, message frequency, message exposure distributions have been attempted in both the advertising industry and the academic field. The most common technique utilized is adjusting the portion of the vehicle audiences of the schedule using such numerical weights as recall and recognition scores. The shortcoming of these weighting methods is there is no clear-cut procedure and weight universally accepted and used in the field of advertising. This is because many different weighting techniques and different weights were employed to suit a particular marketing or media planning circumstance.

The goal in this study is to develop the better procedure to estimate message exposure distributions of network television advertising schedules. The better procedure will be a simple, accurate, parsimonious, convenient, and reliable media model with adaptability to various marketing situations which differ in gross audiences and other schedule characteristics, such as gross rating points (GRPs), the number of programs and insertions. To accomplish this goal, this study aims at developing the regression equation model which can be used to predict message exposure distributions as a function of vehicle exposure distributions and other schedule characteristics, such as vehicle gross rating points (vehicle GRPs), frequency levels, the number of insertions, and the number of programs.

Compared with the previous weighting approaches, this regression equation model, which can be used to estimate message exposure distributions of network television advertising schedules, offers several advantages from the perspective of advertisers. The first advantage is that this regression equation model offers is that media planners do not have to use as weights such data on communication effects as recall and recognition scores.

The second advantage it offers is that this model incorporates the target audience's real world message viewing behaviors. That is, the actual message rating data were used in developing this regression equation model.

The third advantage is that this regression equation model can deal with a variety of marketing situations which differ by their levels of gross audience, vehicle exposure distributions, the number of programs, and the number of insertions. This is because this equation model is developed using a variety of predictor variables such as vehicle exposure distributions and schedule characteristics, such as vehicle GRPs and the number of insertions and programs.

The additional advantage this regression equation model offers could be that it helps to better understand the functional relationship between the message exposure distribution and the vehicle exposure distribution and other schedule characteristics such as vehicle GRPs, frequency, the number of insertions and programs.

Procedures for Developing the Regression Equation Model

The use of the curve fitting approach

The curve fitting approach was used to generate the regression equations for estimating message exposure distributions of network television advertising schedules. The curve fitting approach aims at determining a particular line or curve that best fits the data so that the empirically driven curve is used to predict the criterion (dependent) variables. The curve fitting technique involves such statistical procedures as linear regression analysis or curve fitting and nonlinear techniques such as the maximum likelihood method. A linear regression analysis is used when there is a linear relationship between a criterion variable and one or more predictor variables, while nonlinear regression analyses are used when there is a nonlinear relationship between a criterion variable and one or more predictor variables.

The literature on media planning and evaluation shows that a variety of curve fitting approaches were employed by media researchers. In one curve fitting approach, reach was predicted as a linear function of the number of spots from the empirically driven regression equation (Leckenby & Kim, 1992). Another curve fitting approach involves the application of the nonlinear curve representing the relationship between gross rating points (GRPs) and reach. In this case, GRPs for any subsequent schedule

could be used as input to predict reach from the empirically derived curve (Leckenby & Kim, 1992; Lancaster & Katz, 1988).

A variety of response functions were employed in this study to find out the curve that best fits the data. They are a linear function, a polynomial function with third order, a log-linear function, a double log-linear function, a square root function, and a double square-root function. Six response functional forms of regression equations are as follows:

1. Linear: $$MED_i = b_0 + b_1VED_i + b_2F_i + b_3GRP_i + b_4S_i + b_5P_i + e_i, \quad (9)$$

2. Polynomial: $$MED_i = b_0 + b_1VED_i + b_2VED_i^{\,2} + b_3VED_i^{\,3} + e_i, \quad (10)$$

3. Log-Linear: $$MED_i = b_0 + b_1(\ln VED_i) + b_2(\ln F_i) + b_3(\ln GRP_i) + b_4(\ln S_i) + b_5(\ln P_i) + e_i\,, \quad (11)$$

4. Double Log: $$\ln MED_i = b_0 + b_1(\ln VED_i) + b_2(\ln F_i) + b_3(\ln GRP_i) + b_4(\ln S_i) + b_5(\ln P_i) + e_i\,, \quad (12)$$

5. Square-Root: $$sq\ MED_i = b_0 + b_1(sq\ VED_i) + b_2(sq\ F_i) + b_3(sq\ GRP_i) + b_4(sq\ S_i) + b_5(sq\ P_i)+ e_i\,, \quad (13)$$

6. Double Square: $$sq\ MED_i = b_0 + b_1(sq\ VED_i) + b_2(sq\ F_i) + b_3(sq\ GRP_i) + b_4(sq\ S_i) + b_5(sq\ P_i) + e_i\,, \quad (14)$$

where MED = message exposure distributions,

VED = vehicle exposure distributions,

F = frequency levels,

GRP = gross rating points (GRPs),

S = number of insertions,

P = number of programs,

i = a particular monthly schedule, where i = 1 to 508,

b_0 = intercept or estimated constant,

b_1, b_2, b_3, b_4, b_5 = multivariate regression coefficients,

e_i = error or disturbance term with a mean of zero and normally distributed.

The best curve was selected based on the combination of a variety of criteria, including face validity, adjusted R^2, relative simplicity, and the relative significance of the regression coefficients, among others.

The computer software program, SYSTAT (The System for Statistics), was used to conduct a regression analysis in developing the equation. The data used to fit the curves were obtained from the estimates of vehicle and message exposure distributions obtained from a total of 508 sample television advertising schedules by using the BBD-L model.

Decision on predictor (independent) variables

The starting point of the curve fitting approach in this study is to determine independent variables to be used to predict message exposure distributions of network television advertising schedules, which serve as a dependent variable. The author had a prior assumption that message exposure distributions have a functional relationship with vehicle exposure distributions and other schedule characteristics such as vehicle GRPs, frequency, the number of insertions, and the number of programs.

To support this assumption, a Pearson correlation analysis was conducted using all of the available schedule characteristic variables including the vehicle exposure distributions, GRPs, frequency, the number of programs, and the number of

insertions. The Pearson correlation matrix shows that the vehicle exposure distributions (r = .98) are most correlated with the message exposure distributions, followed by frequency (r = -.83), GRPs (r = .158), the number of insertions (r = .15), and the number of programs (r = .138).

The results of a stepwise regression analysis also found that the vehicle exposure distributions are most useful in predicting the message exposure distributions, followed by GRPs, frequency, the number of insertions, and the number of programs. The overall predicting power of these variables ($R^2 = .970$) was very high. The regression coefficients of these variables, except for the number of programs, were also highly significant at the .05 level.

These independent variables were worthwhile as predictors and therefore were regressed against the message exposure distributions using various response functions to generate the regression equations. The bottom line efforts of increasing the predicting power of the equation in this study were to include all of these schedule characteristics in developing the regression equations.

CHAPTER VI
RESULTS

The Results of the Tests of Hypotheses

Test of Equality of Vehicle and Message Exposure Distributions

Hypothesis 1, which suggests there are statistically significant differences between the vehicle and message exposure distributions with respect to the relationship between the percent of the target audience across frequency levels, was tested using the F-test. Adjusting for sample sizes and the degrees of freedom, the overall F ratio was computed using Equation 7 described above. The results show that the obtained F value ($F = 20.44$) is bigger than the critical F value ($F_{1,\ 10{,}075} = 6.66$) at the one percent significance level, indicating that Hypothesis I was supported. In other words, the combined error sums of square for vehicle and message exposure distribution regressions (ESS_c) and the error sums of square for the pooled vehicle and message exposure distribution regression (ESS_p) differ by a significant amount and therefore vehicle exposure distributions do not equal message exposure distributions.

Table 12 below presents the results of regression of these vehicle, message, and pooled exposure distributions including the three estimated regression equations, their constants, regression coefficients, adjusted R square, ESS, F value, and the number of the total schedules analyzed.

Table 12
The Results of Regression of the Vehicle, Message, and Pooled Exposure Distributions

Distribution	Constant	Coefficient	$\overline{R^2}$	F	ESS	N
Pooled	27.540* (.232)	-11.003*(F) (.262)	.844	13,590.9*	275,912.7	10,080
		2.054*(F^2) (.091)				
		-0.186*(F^3) (.012)				
		.006*(F^4) (.001)				
Message	28.983* (.289)	-12.579*(F) (.327)	.880	9,208.5*	145,038.0	5,040
		2.469*(F^2) (.114)				
		-.230*(F^3) (.015)				
		.008*(F^4) (.001)				
Vehicle	26.097* (.352)	-9.426*(F) (.398)	.817	5,626*	131,434.9	5,040
		1.639*(F^2) (.138)				
		-.141*(F^3) (.019)				
		.005*(F^4) (.001)				

Note: Standard errors in parentheses; * indicates .01 level of significance

Direction of Differences Between Vehicle and Message Exposure Distribution Curves

Test of differences in the intercept between vehicle and message exposure distribution curves

Hypothesis 2, which is that statistically significant differences exist, was tested using the paired t-test. The results of the paired t-test found that the t-ratio was 4.558 which is significant beyond 0.01 level. Therefore, statistically significant differences exist in the intercept between the vehicle and message exposure distribution curves.

The frequency analysis of 508 vehicle exposure distributions and 508 matching message exposure distributions further indicates that there are two directions of the difference in the intercept between the vehicle and message exposure distribution curves. The first direction of the difference in the intercept is that the intercept of the vehicle exposure distribution curve is bigger than that of the message exposure distribution curve, while the second direction of the difference in the intercept is that the intercept of the message exposure distribution curve is bigger than that of the vehicle exposure distribution curve.

In 196 of a total of 508 television advertising schedules analyzed, the intercept of the vehicle exposure distribution curve topped that of the message exposure distribution curve, while in 312 of the 508 schedules, the intercept of the message exposure distribution exceeded the intercept of the vehicle exposure distribution curve.

In cases where the intercept of the message exposure distribution curve lay above that of the vehicle exposure distribution curve, intersection between two curves was likely to occur at the frequency levels ranging from one to four.

Intersection points were likely to differ based on different sizes of vehicle GRPs. For example, in 86 percent of the 146 schedules with vehicle GRPs ranging from 240 to 415, intersection was likely to occur at the point between the frequency

levels of one and two, while, in 75 percent of the 40 schedules with more than 550 vehicle GRPs, intersection was likely to occur at the point between the frequency levels of three and four. This indicates that the percentage of message audience members is higher than that of vehicle audience members at low frequency levels such as one, two, three, or four across various vehicle GRPs levels.

The following four graphs show the various patterns of intersection between the two curves based on different sizes of vehicle GRPs.

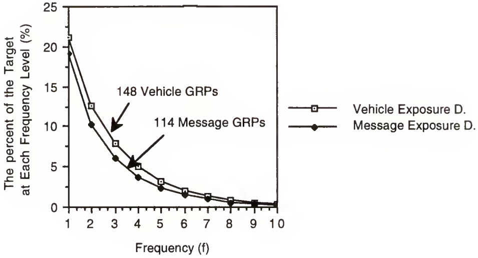

Figure 3. No Intersection Between Two Curves

The graph above shows that the vehicle exposure distribution curve lies above the message exposure distribution curve at all frequency levels. That is, there is no intersection between the vehicle and message exposure distribution curves. This pattern of the relationship between the two curves was most likely to occur when the vehicle GRPs of a schedule is less than 240. In 89 percent of the 208 schedules with less than 240 vehicle GRPs, this pattern of no intersection occurred between the vehicle and message exposure distribution curves.

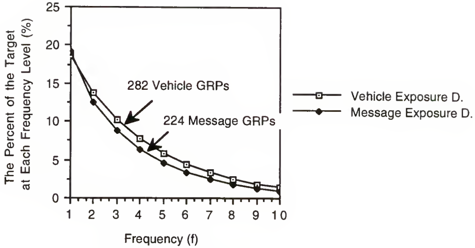

Figure 4. Intersection Between One and Two Frequency Levels

The graph above shows that there is an intersection at the middle point of frequency levels of one and two. This pattern of the relationship between the vehicle and message exposure distributions of the schedules was most likely to occur when vehicle GRPs range from 240 to 415. This pattern of the relationship was shown in 86 percent of the 146 schedules with vehicle GRPs ranging from 240 to 415.

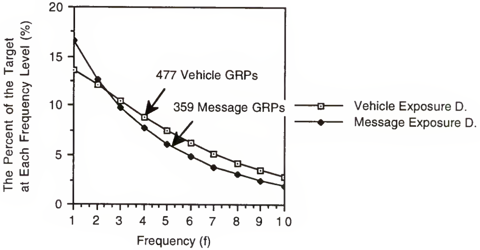

Figure 5. Intersection Between Two and Three Frequency Levels

In the pattern of the relationship between the vehicle and message exposure distribution curves shown in Figure 5 above, intersection is likely to occur between the two and three frequency range. In other words, the message exposure distribution curve lies above the vehicle exposure distribution curve at the frequency levels of one and two. This pattern of intersection was dominant when the vehicle GRPs range from 416 to 560. The frequency analysis showed that 83 percent of the 114 schedules with vehicle GRPs ranging from 415 and 560 had this pattern of intersection between the two curves.

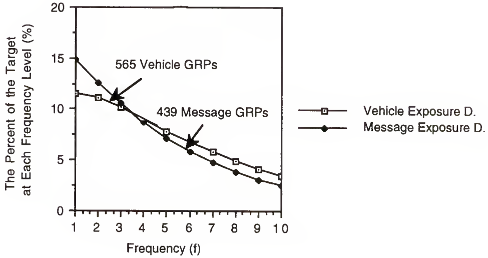

Figure 6. Intersection Between Three and Four Frequency Levels

The last pattern of intersection between the vehicle and message exposure distribution curves is that intersection is likely to occur between the three and four frequency range. This kind of pattern is most common in the schedules with more than 560 vehicle GRPs. The frequency analysis showed that 75 percent of the 40 schedules with more than 560 vehicle GRPs had this pattern of relationship between the two curves.

The reason that the message exposure distribution can lie above the vehicle exposure distribution at low frequency levels has a simple practical explanation. The more vehicle GRPs in a schedule, the more likely it is that audience members exposed to high vehicle frequency, receive a lower message frequency, thus, the build-up of message GRPs at low frequency levels.

Test of differences in the slope between vehicle and message exposure distribution curves

Regarding the test of Hypothesis 3 which suggests there are differences in the slopes between the vehicle and message exposure distribution curves, the results show that the obtained F value ($F = 521.19$) is bigger than the critical F value ($F_{1, 5,035} = 6.66$) at the one percent significance level. This means that the null hypothesis, which is that there is no difference in regression coefficients between the vehicle and message exposure distribution curves, was rejected.

Therefore, statistically significant differences exist in the slopes between the vehicle and message exposure distribution curves. The findings also show the message exposure distribution curve is generally more negatively sloped than the vehicle exposure distribution curve. The results indicate that it would be misleading to use the vehicle exposure distribution as a proxy of the message exposure distribution.

In conclusion, the results of this hypothesis testing suggest that media planners might need to adjust their effective reach goals and strategies because the percentage of message audience members is higher than that of vehicle audience members at low frequency levels such as one, two, three, or four. That is, if the optimal frequency level is two and intersection between two distribution curves occurs at the frequency levels of three or four, the percentage of message audience members exposed to these

optimal frequency levels could be substantially higher than expected, thereby leading media planners to adjust their message effective reach goals to accomplish their eventual advertising and marketing objectives.

Suggestion of the Specific Forms of the Regression Equation Models

The specific forms of the regression equation models obtained using the SYSTAT (The System for Statistics) program are presented in Table 13. Based on the results of a regression analysis presented, various functional forms of regression equations appear to represent the data well.

All of the equations developed have a high adjusted R square, the coefficient of determination, ranging from .856 to .997, indicating that the independent variables of these equations were very accurate in predicting individual message exposure distributions.

The results of the F-test of each equation (significant at $p < .01$) also show that the null hypothesis, which is that all of the regression coefficients are zero, was rejected, which suggests that these independent variables were useful as predictors.

Based on the comparison of the adjusted R square and other statistical criteria, the best regression equation in terms of the accuracy of the predictions is the double log-linear model. The adjusted R square of this equation, .997, is the highest of all, indicating that 99.7 percent of the variation in the message exposure distribution measurements can be explained by this fitted regression equation. The size of the standard error of the estimate, .084, is noticeably small, which suggests that 95 percent of message exposure distributions can be predicted within plus or minus 0.16 (e.g., 1.96 x .084).

Table 13
<u>The Specific Forms of the Regression Equation Models</u>

Regression Equation Model	$\overline{R^2}$	F	N
Linear			
MED = -.694* + .995*(VED) (.023) (.003)	.965	139,800.8*	5,040
MED = .103* + .917*(VED) - .168*(F) (.076) (.005) (.009) + .003*(GRP) - .006*(S) + .004*(P) (.000) (.003) (.002)	.969	31,552.9*	5,040
Polynomial (3th order)			
MED = .126* + .471*(VED) +.062*(VED^2) (.034) (.015) (.002) - .002*(VED^3) (.000)	.974	61,889.7*	5,040
Log-linear			
MED = 17.297 - 7.595*(ln F) (.072) (.044)	.856	29,839.1*	5,040
MED = 5.396 + .099*(ln VED) -7.599*(ln F) (.364) (.031) (.055) + 2.489*(ln GRP) - .970*(ln S) + .596 (ln P) (.169) (.170) (.058)	.914	10,638.2*	5,036[a]
Double-log			
ln MED = -.333* + 1.074*(ln VED) (.003) (.001)	.991	533,065.3*	5,033[b]
ln MED = -.252* + .954*(ln VED) -.257*(ln F) (.018) (.002) (.003) - .067*(ln GRP) + .236*(ln S) - .020 (ln P) (.008) (.008) (.003)	.997	320,648.8*	5,033[b]

Table 13- Continued

Regression Equation Model	$\overline{R^2}$	F	N
Square root			
MED = -5.144* + 4.765*(Sq VED) (.066) (.025)	.874	34,913.4*	5,040
MED = 4.213* + 3.353*(Sq VED) -2.781*(Sq F) (.267) (.056) (.091) + .059*(Sq GRP) - .240*(S) + .059**(P) (.026) (.064) (.026)	.905	9,548.2*	5,040
Double-square root			
Sq MED = -.248* + 1.027*(Sq VED) (.005) (.002)	.980	247,278.0*	5,040
Sq MED = .854* + .779*(Sq VED) -.426*(Sq F) (.017) (.004) (.006) + .021*(sq GRP) + .005**(S) + .007*(P) (.002) (.004) (.002)	.991	106,189.9*	5,040

Note: Standard errors in parentheses
* indicates .01 level of significance
** indicates .05 level of significance
a and *b* indicate the sample size varies due to missing data occurring in a particular regression analysis.
MED = message exposure distribution,
VED = vehicle exposure distribution,
F = frequency,
GRP = gross rating points,
P = the number of programs,
S = the number of insertions.

On the other hand, the most parsimonious model is the log-linear model which has one predictor variable, vehicle exposure distributions, and R square of .911.

The models which have the least predicting power are the simple log-linear model and the square-root model, of which adjusted R square is .856 and .874, respectively. This indicates that it is better not to use these functional forms of the equation.

While vehicle exposure distributions are used as the best predictor variable in most functional forms of the equation, in the simple log-linear model, frequency levels appear to be the best predictor variable.

In short, since the accuracy in the estimation of message exposure distributions of network television advertising schedules is the most important criteria of evaluating the performance of media evaluation models, the double log-linear model, which has the highest adjusted R square of .997, is recommended as the best model of a total of eleven regression equation models used to estimate message exposure distributions of network television advertising schedules.

The Test of the Accuracy of the Double Log-Linear Model

The Four Definitions of Error

Since the double log-linear model has the highest predicting power with R square of .996, it is necessary to test the accuracy of this model to see whether there could be substantial differences between the predictions made by this model versus the actual estimates of the message exposure distributions generated by the BBD-L model. A total of 300 network television advertising schedules, which were not used in developing the regression equations, were used to test the predictive ability of the double log-linear model. This sample size of 300 schedules was determined based on

the fact that "from the statistical inference point of view, little is to be gained by having a sample size over 300 schedules" (Leckenby and Kim, 1992).

Four error terms were employed as criteria to test the double log-linear model's ability to predict the message exposure distributions generated by the BBD-L model. These four error terms represent a variety of measures of the closeness of fit between the double log-linear model's estimates of message exposure distributions and the BBD-L model's estimates of message exposure distributions.

Four error terms were 1) average error in reach (AER), 2) average error in distribution (AED), 3) accuracy in reach estimations, and 4) accuracy in exposure level estimations. These four error terms have been widely used in previous studies (Leckenby & Kishi, 1984; Leckenby & Rice, 1985; Leckenby & Rice, 1986; and Ju, Lee, & Leckenby, 1990).

Average error in reach (AER) is defined as the absolute difference between the model's estimated reach and the BBD-L model's estimated reach. Average error in the distribution (AED) are the absolute values of the differences between the regression equation model's estimated values and the BBD-L model's estimated values summed over all exposure levels in the distribution. In addition, to test the accuracy in reach and exposure level estimations, the number of estimates within the plus and minus five percent range of the BBD-L estimates value were calculated for the exposure distribution and reach. This analysis shows the model's systematic patterns of overestimation (more than + 5 percent error) or underestimation (more than -5 percent error) (Leckenby & Kishi, 1984).

The definitions of these four error terms are presented Table 14 below.

Table 14
Four Definitions of Error

Error Terms	Definitions
Average Error in Reach (AER)	$AER = \left(\sum_{i=1}^{N} \lvert O_i - E_i \rvert \right) / N$ where: O_i = BBD-L's message reach of schedule i E_i = estimated message reach of schedule i N = total number of schedules
Average Error in Distribution (AED)	$AED = \{ \sum_{i=1}^{N} (\sum_{j=1}^{n_i} \lvert O_{ij} - E_{ij} \rvert) \} / N \; (j = 1, 2, \text{---} \, n_i)$ where: O_{ij} = BBD-L's message audience at exposure level of j of schedule i E_{ij} = estimated message audience at exposure level of j of schedule i n_i = number of insertions in schedule i N = total number of schedules
Accuracy in Reach estimations	Close estimation: if $O_i * (.95) \leq E_i \leq O_i * (1.05)$ where: O_i = BBD-L's message reach of schedule i E_i = estimated message reach of schedule i
Accuracy in Exposure Level estimations	Close estimation: if $O_{ij} * (.95) \leq E_{ij} \leq O_{ij} * (1.05)$ where: O_{ij} = BBD-L's message audience at exposure level of j of schedule i E_{ij} = estimated message audience at exposure level of j of schedule i

The Results of the Test of the Accuracy of the Double Log-Linear Model

The average errors in estimation of reach and exposure distribution across the 508 schedules for the two models are given in Table 15 below. The double log-linear model produced an average error in reach (ER), 1.96 percent, and an average error in the distribution (ED), 3.1 percent. These results indicate that this model displays great accuracy in predicting the message exposure distribution and message reach, compared with the BBD-L model.

Table 15
Average Errors in Reach and the Distribution for the Double Log-Linear Model

Error Terms	Average Error	N
Average Error in Reach (AER)	1.96%	300[a]
Average Exposure Distribution (AED)	3.1%	2,965[b]

a = total number of television advertising schedules
b = total number of frequencies in 300 schedules

Table 16 below shows the number of over, under, and close estimations in message reach and the message exposure distribution for systematic bias. This double log-linear model performed well, estimating message reach and the message exposure distribution with five percent accuracy in 265 out of the 300 schedules, and 1,767 out of a total of 2,965 frequencies in 300 schedules, respectively. It underestimated the message exposure distribution by more than five percent in 679 out of 2,965 frequencies, while it overestimated message reach by more than five percent in only 27

out of 300 schedules. This is relatively small considering the sample size of 300 schedules.

There is no evident bias in the direction either overestimation or underestimation of message reach and the message exposure distribution. However, overall the double log-linear model displays some propensity to underestimate message reach compared with the BBD-L model.

Table 16
Number of Over-, Under-, and Close-Estimations Within Plus and Minus Five Percent of the BBD-L's Reach and Exposure Distribution (in Number and Percent)

Error Terms	Over 5%	Under 5%	Within 5%	N
Reach	27 (8.9%)	8 (2.7%)	265 (88.4%)	300[a]
Exposure Distribution	517 (17.4%)	679 (22.9%)	1,767 (59.6%)	2,965[b]

a = total number of television advertising schedules
b = total number of frequencies in 300 schedules

This model is also easy to use because it can be incorporated into any computerized media evaluation or selection model which is capable of estimating exposure distributions of television advertising schedules.

CHAPTER VII
SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary and Conclusions

Due to the constantly rising cost of advertising space and time, maximizing the effectiveness of media inputs (e.g., media expenditures) has become a major concern in media planning. Effective media planning is most important in maximizing the effectiveness of media inputs.

Developing and evaluating media schedules on the basis of advertising exposure is one of the most important decision making processes in media planning. Without the accurate media evaluation, the effectiveness of media planning or media plans will diminish.

Today, one of the most fundamental concerns of media planners is the discrepancy between vehicle and advertising exposures inherent in syndicated media audience research data. The discrepancy between vehicle and advertising exposures could result in the wrong evaluation of the impact of an television advertising schedule on the target audience. This wrong evaluation results from the erroneous estimation of true audience exposure patterns such as message reach, frequency, effective reach, gross rating points (GRPs), and exposure distributions.

The results of hypothesis testing show not only statistically significant differences exist between the vehicle and message exposure distribution curves, but

there are statistically significant differences in the intercept and the slope between the vehicle and message exposure distribution curves.

Furthermore, in cases where gross rating points (GRPs) of a particular television advertising schedule are more than 200, the percentage of message audience members is likely to be higher than that of vehicle audience members at low frequency levels such as one, two, three, or four.

These empirical findings imply that the discrepancy between vehicle and advertising exposures can indeed lead media planners who rely solely on vehicle audience data to the erroneous evaluation of the impact of a television advertising schedule on the target audience.

This study also suggested a variety of accurate, parsimonious, and reliable regression equation models used to estimate message exposure distributions of television advertising schedules. A total of eleven regression equation models were suggested and appeared to be accurate in predicting message exposure distributions of network television advertising schedules based on vehicle exposure distributions and other schedule characteristics such as vehicle gross rating points (veicle GRPs), frequency levels, the number of programs, and the number of insertions. An adjusted R square of these eleven regression equation models ranges from .856 to .997.

The most accurate equation model was the double log-linear model with an adjusted R square of .997, which indicates that 99.7 percent of the variation in the message exposure distribution measurements can be explained by vehicle exposure distributions and other schedule characteristics such as frequency levels, vehicle GRPs, and the number of insertions and programs. The most parsimonious models were the simple log-linear equation model and the simple double log-linear model having only

one predictor variable each, which were frequency and vehicle exposure distribution, respectively.

Since the accuracy of the estimation is the most important criteria of evaluating the performance of media evaluation models, the double log-linear model is recommended as the best model to use in estimating message exposure distributions of network television advertising schedules.

The results of the accuracy test of the double log-linear model show that an average error in reach (AER) and an average error in the distribution (AED) produced by this model were 1.96 and 3.1 percent, respectively, indicating this model produces message reach and exposure distributions highly close to those of the BBD-L model.

In practice, this double log-linear model can be employed by media planners in estimating message audiences of network television advertising schedules and incorporating these estimates of message audiences into developing and evaluating network television advertising schedules on the basis of advertising exposure.

Implications

There are some empirical data about the differences between vehicle and advertising exposures and how to equate vehicle exposures to advertising exposures. However, there is little empirical evidence about how the discrepancy between vehicle and advertising exposures impacts on the development and evaluation of television advertising schedules.

This study is a pioneering work to examine how the discrepancy between vehicle and advertising exposures results in the erroneous estimation of the impact of

network television advertising schedules on the target audience by empirically comparing vehicle exposure distributions with message exposure distributions.

The empirical findings of this study will help researchers to lay theoretical foundations about how the discrepancy between vehicle and advertising exposures results in the erroneous estimation of the impact of network television advertising schedules on the target audience. These empirical findings further help them to accumulate theoretical underpinnings toward building a comprehensive media planning theory. The empirical findings will also make media planners, educators, and researchers more aware of the importance of this issue in both the advertising industry and academia; therefore, they can serve as a useful point of departure for additional research related to this issue.

The double log-linear regression equation model developed in this study will also benefit several constituencies such as media planners and educators. Since message rating data will not be readily available to media planners for several years, this regression equation model can be used by media planners or educators 1) to estimate message audiences of network television advertising schedules, 2) to develop message effective reach goals, and 3) to compare and evaluate various network television advertising schedule alternatives in terms of advertising exposure.

Finally, the development of this regression equation model will encourage researchers or model builders to explore better ways of estimating message audiences rather than vehicle audiences for other media categories such as magazines, newspapers, and radio.

Limitations

There are several limitations related to this study. The first limitation is that the author employed only the BBD-L model as a mathematical basis of estimating vehicle and message exposure distributions of network television advertising schedules. Even though the BBD-L is one of the most popular and widely used models in practice, there are also some other exposure distribution estimation models used in either the advertising industry or academia. The use of other models might results in the different regression equation model with different estimates of parameters and regression coefficients.

There is also another minor problem inherent in the BBD-L model. The BBD-L model does not require as inputs duplication data such as self- and cross-pair ratings. Instead the BBD-L model estimates duplication data using the self- and cross-pair estimating regression equations. These two regression equations have estimation errors even though these errors are not big enough to distort the results of this study.

Vehicle and message ratings were also collected from the relatively small size of sample population in only Seoul metropolitan area, which include a population of 11 million. The use of national audience data are better than that of these local area rating data.

The shortcoming inherent in the double log-linear regression equation model is that this model might not handle potential estimation errors or bias resulting from the differences in the ratios of message to vehicle ratings because this ratio factor was not included as the predictor variable in the model.

There also are multicollinearity problem which are inherent in the regression analysis used in this study. A Pearson correlation analysis shows that there is a high

correlation between two predictor variables, vehicle exposure distributions and frequency levels ($r = -.826$). Since the purpose of this study is to develop the regression equation model which has the highest predicting power, however, this problem is not the serious limitation of this study. The multicollinearity problem is serious when a regression equation is used to gain an understanding of how the predictor variables influence the criterion variable. It has nothing to do with the predicting power of a regression equation.

Finally, the double log-linear regression equation model developed might not be applicable to U.S. media planning situations because they were developed using Korean vehicle and message audience data. Television viewing habits between the two countries might be different due to differences in culture and media environments. This regression equation model might not accurately predict audience exposure patterns to U.S. network television advertising schedules. Further research using the U.S. vehicle and message ratings could be necessary to develop the regression equation model suitable to audience exposure patterns to U.S. network television advertising schedules.

Suggestion for Further Research

It is necessary to extend this kind of research to other media categories, especially print media such as magazines and newspapers. Print media such as magazines, unlike broadcasting media, have one more conceptual problem inherent in syndicated magazine audience data, which is the difference between single exposure and repeated exposures.

Some magazine readers can be exposed to portions or all magazine pages repeatedly during the life cycle of a particular magazine issue. This tendency for some readers to be exposed repeatedly to the magazine issue could result in repeated (or multiple) exposures to an advertising message within the magazine issue.

Since currently used syndicated magazine audience data cannot measure these repeated (or multiple) exposures, using these data in evaluating a magazine advertising schedule might result in the erroneous message estimation of true media evaluation factors such as message average frequency. Specifically, it might underestimate message average frequency of the magazine advertising schedule because some vehicle exposures to individual magazine issues in the schedule could involve repeated (or multiple) exposures to the ad.

The issue of repeated exposures should be the focus of the further research, along with the issue of the discrepancy between vehicle and advertising exposures.

APPENDIX A
AVERAGE KOREAN NETWORK TELEVISION VEHICLE, NETWORK MESSAGE, AND SPOT MESSAGE RATINGS IN 1993

Dayparts/Time Periods		KBSI			KBS2			MBC			SBS		
		Net.	Spot	Veh.	Net.	Spot	Veh.	Net.	Spot	Veh.	Net.	Spot	Veh.
SA	SA1 (Weekday 20:00-22:30)	-	-	4.1	5.4	4.6	8.1	7.8	7.5	10.1	5.2	3.4	7.0
	SA2 (Saturday 19:00-22:30)	-	4.4	5.2	4.5	4.4	7.7	9.0	8.2	12.1	5.7	3.7	7.8
	SA3 (Sunday 19:00-22:30)	-	3.9	4.1	3.7	3.3	5.4	11.1	10.5	14.8	8.1	5.2	9.8
	Other	-	-	-	4.1	6.1	-	7.7	7.3	-	5.7	4.8	-
A	A1 (Weekday 19:00-20:00)	-	-	3.5	3.7	3.2	4.6	5.7	4.7	6.6	5.4	6.0	6.4
	A2 (Weekday 22:30-23:00)	-	-	2.5	5.5	5.2	5.4	4.9	5.8	10.8	4.8	4.6	7.6
	A3 (Saturday 18:00-19:00)	-	-	2.9	2.9	2.9	3.4	7.1	5.5	10.5	5.0	5.2	6.5
	A4 (Saturday 22:30-23:30)	-	-	1.8	2.9	2.6	7.3	7.2	5.4	11.2	5.3	5.5	8.5
	A5 (Sunday 08:00-19:00)	-	2.9	3.4	3.6	3.2	4.9	6.6	5.7	7.6	4.3	3.5	5.4
	A6 (Sunday 22:30-23:00)	-	-	4.1	2.4	2.6	7.5	7.0	5.5	12.2	5.9	5.0	6.8
	Other	-	-	-	3.7	3.5	-	4.0	3.9	-	4.6	4.9	-
B	B1 (Weekday 07:00-10:00)	-	-	2.7	2.4	2.5	2.6	3.4	3.5	3.7	4.8	4.8	5.0
	B2 (Weekday 17:30-19:00)	-	-	2.8	3.6	2.5	3.8	2.5	2.1	3.2	3.9	3.3	5.1
	B3 (Weekday 23:00-23:30)	-	-	2.5	5.8	6.1	6.8	7.3	6.5	7.6	3.7	-	4.5
	B4 (Saturday 07:00-18:00)	-	1.1	2.5	2.7	2.5	3.1	3.6	3.4	3.9	3.5	3.0	3.6
	B5 (Saturday 23:30-24:00)	-	-	1.3	1.7	2.6	4.7	4.2	-	5.1	-	6.1	9.3
	B6 (Sunday 07:00-08:00)	-	-	1.3	3.0	0.8	1.3	1.7	1.3	1.7	1.3	1.2	2.9
	B7 (Sunday 23:00-23:30)	-	-	5.0	1.5	1.9	2.4	2.5	2.9	4.4	-	-	9.8
	Other	-	-	-	2.8	1.9	-	3.6	1.6	-	2.8	1.7	-
C	C1 (Weekday 06:00-07:00)	-	-	1.2	0.9	0.5	0.9	1.5	1.3	1.4	1.1	0.8	1.0
	C2 (Weekday 10:00-17:30)	-	-	0.4	0.9	-	0.4	1.7	2.2	0.6	1.3	1.2	0.4
	C3 (Weekday 23:30-24:59)	-	-	1.5	2.2	2.5	2.6	1.7	2.2	2.2	1.7	1.8	1.5
	C4 (Saturday 06:00-07:00)	-	-	1.1	1.1	0.7	0.9	0.8	0.9	0.8	1.3	1.1	1.2
	C5 (Saturday 24:00-24:59)	-	-	1.3	-	-	0.5	-	-	3.9	-	-	2.1
	C6 (Sunday 06:00-07:00)	-	-	0.7	0.7	0.7	0.5	0.6	0.6	0.4	0.4	-	0.5
	C7 (Sunday 23:30-24:59)	-	-	1.5	0.3	-	2.2	-	-	3.1	4.2	4.5	5.1
	Other	-	-	-	1.4	1.2	-	2.1	2.6	-	2.1	2.6	-

Net.=Network Message Ratings; Spot=Spot Message Ratings; Veh.=Vehicle Ratings
Periods: 2/1-7, 6/7-13, 9/13-19, 11/22-28, 1993
Sample Size: 275 households including a total of 1,000 targets who are four and more years old
Networks: KBS-1TV, KBS-2TV, MBC-TV, SBS-TV

APPENDIX B
ORIGINAL KOREAN NETWORK TELEVISION VEHICLE, NETWORK MESSAGE, AND SPOT MESSAGE RATINGS IN 1993

'93년 2월 1일부터 '93년 2월 7일까지 시급별 시청률

- 분석기간 : '93년 2월 1일부터 '93년 2월 7일까지
- 분석대상 : 4세이상 모든개인
- 분석방송국 : 4대 방송국(KBS1, KBS2, MBC, SBS)

(단위 : %)

	시급	가중 평균 프로광고	가중 평균 SPOT광고	TOTAL 시간대	KBS1 프로광고	KBS1 SPOT광고	KBS1 시간대	KBS2 프로광고	KBS2 SPOT광고	KBS2 시간대	MBC 프로광고	MBC SPOT광고	MBC 시간대	SBS 프로광고	SBS SPOT광고	SBS 시간대
SA	SA1(평2000-2230)	7.3	6.3	31.2	0.0	0.0	3.7	6.3	6.5	9.1	9.8	9.8	11.9	5.1	2.8	6.5
	SA2(토1900-2230)	7.0	4.4	35.8	0.0	2.7	2.4	3.9	1.9	8.8	10.6	8.4	15.3	7.2	5.3	9.4
	SA3(일1900-2230)	9.0	5.4	39.7	0.0	2.4	2.5	2.7	0.9	6.7	14.4	13.4	18.4	9.1	7.2	12.0
	기 타	5.7	6.7	-	0.0	0.0	-	4.0	9.7	-	7.9	7.4	-	5.2	5.7	-
	소 계	7.2	5.9	33.1	0.0	2.5	3.3	5.1	4.4	8.7	10.2	9.6	13.3	6.2	4.3	7.7
A	A1 (평1900-2000)	6.0	4.9	24.7	0.0	0.0	3.1	4.0	3.7	5.0	6.9	6.0	8.3	7.2	9.2	8.3
	A2 (평2230-2300)	5.0	5.5	26.2	0.0	0.0	2.5	5.6	5.5	7.7	3.6	5.7	9.7	5.9	5.3	6.3
	A3 (토1800-1900)	4.7	3.9	24.5	0.0	0.0	2.0	2.2	2.3	4.7	4.6	3.4	7.8	6.0	6.1	10.0
	A4 (토2230-2330)	7.1	4.6	30.3	0.0	0.0	1.3	3.2	2.6	4.0	7.9	0.0	10.9	8.6	8.8	14.1
	A5 (일0800-1900)	5.6	4.6	23.3	0.0	3.6	2.2	3.5	3.3	4.9	7.8	6.8	9.3	5.4	3.9	6.9
	A6 (일2230-2300)	4.2	2.4	34.1	0.0	0.0	3.5	1.2	1.2	3.5	0.0	0.0	20.1	4.5	4.7	7.0
	기 타	4.3	4.9	-	0.0	0.0	-	4.7	3.7	-	4.3	0.0	-	3.4	6.1	-
	소 계	5.3	4.8	26.2	0.0	3.6	2.6	4.0	3.8	5.8	6.2	6.2	9.9	5.9	5.0	7.9
B	B1 (평0700-1000)	4.1	4.2	15.1	0.0	0.0	2.4	2.5	2.8	2.6	4.5	4.6	4.5	5.4	5.5	5.6
	B2 (평1730-1900)	3.6	3.3	19.2	0.0	0.0	2.5	2.5	2.3	4.8	3.7	2.8	4.4	5.0	5.4	7.4
	B3 (평2300-2330)	4.3	-	18.6	0.0	-	1.8	0.0	-	7.0	0.0	-	4.5	4.3	-	5.2
	B4 (토0700-1800)	3.6	3.2	14.2	0.0	0.6	2.2	2.6	3.0	3.4	4.1	3.8	4.2	4.4	3.4	4.4
	B5 (토2330-2400)	0.3	4.2	28.6	0.0	0.0	0.8	0.3	0.6	1.5	0.0	0.0	13.8	0.0	6.0	12.5
	B6 (일0700-0800)	1.7	1.3	4.8	0.0	0.0	0.3	0.0	0.8	0.6	1.4	1.4	1.2	3.8	0.0	2.6
	B7 (일2300-2330)	-	4.4	30.3	-	0.0	4.0	-	0.0	0.1	-	4.4	17.7	-	0.0	8.5
	기 타	4.4	1.0	-	0.0	0.0	-	2.3	0.0	-	6.3	0.8	-	3.1	1.1	-
	소 계	3.9	3.5	18.0	0.0	0.6	2.1	2.5	2.7	4.1	4.4	3.6	5.5	4.8	4.5	6.3
C	C1 (평0600-0700)	0.8	0.6	2.7	0.0	0.0	0.8	0.7	0.6	0.6	1.0	0.8	0.8	0.6	0.4	0.6
	C2 (평1000-1730)	-	-	2.0	-	-	0.7	-	-	0.6	-	-	0.4	-	-	0.3
	C3 (평2330-2459)	1.7	2.5	7.1	0.0	0.0	1.3	3.0	3.3	2.6	0.0	2.1	1.7	1.6	1.9	1.5
	C4 (토0600-0700)	0.7	0.5	3.1	0.0	0.0	1.1	1.0	0.6	0.7	0.3	0.4	0.5	0.9	0.4	0.8
	C5 (토2400-2459)	-	-	14.0	-	-	1.1	-	-	1.6	-	-	8.4	-	-	2.9
	C6 (일0600-0700)	0.5	0.3	1.3	0.0	0.0	0.2	0.5	0.5	0.2	0.2	0.3	0.2	1.0	0.0	0.7
	C7 (일2330-2459)	0.9	1.9	13.1	0.0	0.0	2.5	0.3	0.0	0.5	0.0	0.0	4.4	3.8	3.9	5.7
	기 타	2.3	2.9	-	0.0	0.0	-	1.0	0.7	-	2.8	3.6	-	2.3	3.7	-
	소 계	1.2	1.7	4.8	0.0	0.0	1.0	0.8	1.4	1.2	1.5	2.2	1.5	1.1	1.6	1.2

'93년 6월 7일부터 '93년 6월 13일까지 시급별 시청률

- 분석기간 : '93년 6월 7일부터 '93년 6월 13일까지
- 분석대상 : 4세이상 모든개인
- 분석방송국 : 4대 방송국(KBS1, KBS2, MBC, SBS)

(단위 : %)

	시 급	가중 평균		TOTAL	KBS1			KBS2			MBC			SBS		
		프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대
SA	SA1(평2000-2230)	5.8	4.9	29.2	0.0	0.0	4.3	5.0	4.4	7.7	6.4	6.1	8.9	5.8	4.4	8.2
	SA2(토1900-2230)	6.4	5.8	35.0	0.0	6.0	6.5	5.3	6.5	9.9	8.7	7.2	11.4	5.8	3.6	7.1
	SA3(일1900-2230)	7.8	5.6	32.7	0.0	4.9	5.2	4.2	4.5	5.8	10.3	9.5	12.1	8.0	4.8	9.6
	기 타	6.4	5.6	-	0.0	0.0	-	4.3	4.0	-	6.3	7.5	-	7.1	4.9	-
	소 계	6.3	5.3	30.5	0.0	5.5	4.7	4.9	4.5	7.7	7.3	6.8	9.7	6.5	4.4	8.2
A	A1 (평1900-2000)	4.1	3.4	17.7	0.0	0.0	2.4	2.5	2.1	3.1	5.0	4.1	5.9	5.1	5.3	6.2
	A2 (평2230-2300)	5.3	5.2	27.1	0.0	0.0	3.3	6.9	6.0	6.3	4.0	4.7	7.5	5.3	5.3	10.1
	A3 (토1800-1900)	5.9	5.1	23.9	0.0	0.0	2.3	3.4	3.3	3.1	9.1	9.3	13.0	5.0	4.3	5.6
	A4 (토2230-2330)	4.4	3.9	30.3	0.0	0.0	1.2	2.3	2.6	9.9	6.4	6.3	11.2	4.8	3.9	8.0
	A5 (일0800-1900)	4.9	4.2	21.9	0.0	3.4	4.5	4.0	3.4	5.0	6.6	6.0	7.7	4.0	3.5	4.7
	A6 (일2230-2300)	6.9	5.5	33.0	0.0	0.0	2.9	4.2	4.3	11.4	0.0	5.4	10.0	7.5	7.0	8.7
	기 타	4.3	3.2	-	0.0	0.0	-	3.0	1.7	-	4.7	3.1	-	7.1	6.8	-
	소 계	4.7	4.3	23.8	0.0	3.4	2.8	3.6	3.3	5.5	5.9	5.0	7.8	4.7	4.7	7.8
B	B1 (평0700-1000)	3.5	3.4	14.3	0.0	0.0	2.9	2.8	2.7	2.9	2.7	2.6	3.2	5.0	5.0	5.2
	B2 (평1730-1900)	2.6	2.3	12.4	0.0	0.0	1.9	2.2	1.6	2.6	1.8	1.6	2.3	4.4	3.7	5.7
	B3 (평2300-2330)	6.5	6.5	19.1	0.0	0.0	2.9	5.6	6.3	6.7	9.2	7.1	5.7	8.2	0.0	3.8
	B4 (토0700-1800)	3.4	2.9	13.7	0.0	1.1	2.5	3.6	3.3	4.2	3.3	2.9	3.6	3.3	2.8	3.4
	B5 (토2330-2400)	2.7	6.2	18.3	0.0	0.0	1.1	2.7	4.5	5.0	0.0	0.0	1.3	0.0	7.1	10.9
	B6 (일0700-0800)	2.5	1.0	8.7	0.0	0.0	2.2	2.9	0.7	1.7	1.9	0.5	1.4	1.7	2.0	3.4
	B7 (일2300-2330)	2.7	3.1	23.7	0.0	0.0	7.9	2.4	3.1	2.8	2.9	0.0	4.0	0.0	0.0	9.0
	기 타	2.9	2.4	-	0.0	0.0	-	2.0	2.6	-	2.6	2.2	-	3.2	2.3	-
	소 계	3.4	3.1	15.4	0.0	1.1	2.7	3.1	2.9	3.9	2.8	2.4	3.5	4.3	4.0	5.3
C	C1 (평0600-0700)	1.6	1.2	5.6	0.0	0.0	1.4	1.1	0.5	1.0	1.7	1.8	1.8	1.7	1.2	1.4
	C2 (평1000-1730)	-	1.8	1.6	-	0.0	0.4	-	0.0	0.3	-	1.0	0.6	-	0.0	0.3
	C3 (평2330-2459)	1.7	1.8	7.5	0.0	0.0	0.8	0.0	0.0	2.8	1.8	1.9	2.7	1.4	1.7	1.2
	C4 (토0600-0700)	1.6	1.5	5.0	0.0	0.0	0.9	1.1	0.3	0.8	1.1	1.1	1.0	2.4	2.3	2.2
	C5 (토2400-2459)	-	-	7.4	-	-	1.5	-	-	1.4	-	-	2.0	-	-	2.5
	C6 (일0600-0700)	0.5	0.7	2.8	0.0	0.0	0.8	1.5	1.5	0.9	0.4	0.4	0.5	0.0	0.0	0.6
	C7 (일2330-2459)	-	-	12.0	-	-	2.3	-	-	2.1	-	-	3.0	-	-	4.6
	기 타	2.2	2.0	-	0.0	0.0	-	1.3	0.7	-	1.5	2.2	-	3.1	3.1	-
	소 계	1.6	1.5	5.3	0.0	0.0	1.0	1.1	0.6	1.4	1.5	1.6	1.7	2.0	1.8	1.3

'93년 9월 13일부터 '93년 9월 19일까지 시급별 시청률

- 분석기간 : '93년 9월 13일부터 '93년 9월 19일까지
- 분석대상 : 4세이상 모든개인
- 분석방송국 : 4대 방송국(KBS1, KBS2, MBC, SBS)

(단위 : %)

	시급	가중 평균		TOTAL	KBS1			KBS2			MBC			SBS		
		프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대	프로광고	SPOT광고	시간대
SA	SA1(평2000-2230)	5.7	4.5	28.0	0.0	0.0	4.3	4.9	3.8	7.2	7.0	6.6	9.5	5.0	3.2	7.0
	SA2(토1900-2230)	6.2	6.1	31.7	0.0	4.8	6.9	4.3	5.3	5.3	7.3	7.7	11.7	6.6	3.6	8.9
	SA3(일1900-2230)	7.7	5.0	31.4	0.0	3.7	4.3	4.1	3.8	4.6	8.4	8.0	12.6	9.5	5.4	9.9
	기 타	5.8	5.1	-	0.0	0.0	-	3.1	4.8	-	7.3	5.7	-	5.6	4.6	-
	소 계	6.1	4.8	29.0	0.0	4.2	4.5	4.5	4.1	6.6	7.3	6.6	10.3	6.2	3.8	7.7
A	A1 (평1900-2000)	4.2	3.0	19.5	0.0	0.0	4.6	3.2	2.9	3.9	4.8	0.0	5.8	4.4	3.5	5.2
	A2 (평2230-2300)	5.1	4.5	26.4	0.0	0.0	1.4	6.5	5.2	4.4	5.0	5.5	13.4	3.8	3.5	7.2
	A3 (토1800-1900)	3.9	3.2	20.3	0.0	0.0	2.0	1.9	2.7	2.3	6.1	3.7	10.3	0.0	0.0	5.7
	A4 (토2230-2330)	4.4	3.3	27.0	0.0	0.0	2.3	2.4	1.9	6.4	1.7	2.0	10.2	5.5	5.2	8.1
	A5 (일0800-1900)	4.2	3.5	18.8	0.0	2.5	3.2	3.4	3.0	6.0	5.6	4.8	6.0	3.6	3.2	4.7
	A6 (일2230-2300)	1.4	1.8	26.9	0.0	0.0	6.6	0.0	0.0	7.9	0.0	0.0	9.3	1.4	1.8	4.0
	기 타	2.9	3.1	-	0.0	0.0	-	3.1	2.5	-	2.6	3.3	-	3.7	3.8	-
	소 계	4.0	3.6	23.0	0.0	2.5	3.1	3.4	3.1	4.5	4.8	4.3	9.4	3.8	3.4	6.0
B	B1 (평0700-1000)	3.4	3.3	13.4	0.0	0.0	2.5	2.2	2.1	2.4	2.5	2.5	2.8	6.8	5.7	5.6
	B2 (평1730-1900)	2.7	1.8	13.2	0.0	0.0	3.3	3.6	2.4	3.9	1.6	1.5	2.1	3.2	1.8	3.9
	B3 (평2300-2330)	5.5	6.2	17.1	0.0	0.0	2.5	5.9	5.8	6.9	8.1	7.8	4.2	3.0	0.0	3.5
	B4 (토0700-1800)	3.0	2.4	11.6	0.0	0.8	2.6	2.3	1.8	2.8	3.2	3.0	3.1	3.5	3.2	3.2
	B5 (토2330-2400)	-	5.3	18.2	-	0.0	1.5	-	0.0	4.1	-	0.0	1.4	-	5.3	11.3
	B6 (일0700-0800)	2.4	0.9	6.8	0.0	0.0	1.1	2.9	0.9	1.5	1.4	0.5	1.3	1.3	1.5	2.9
	B7 (일2300-2330)	0.7	0.6	22.9	0.0	0.0	5.5	0.7	0.6	1.5	0.0	0.0	11.1	0.0	0.0	4.9
	기 타	2.6	1.5	-	0.0	0.0	-	1.3	1.1	-	2.1	1.6	-	3.3	2.0	-
	소 계	3.2	2.7	14.6	0.0	0.8	2.7	2.8	2.2	4.0	2.5	2.2	3.3	4.3	3.9	4.6
C	C1 (평0600-0700)	1.5	1.0	5.1	0.0	0.0	1.2	1.6	0.7	1.1	1.7	1.5	1.5	1.2	0.9	1.2
	C2 (평1000-1730)	1.3	2.1	2.1	0.0	0.0	0.3	0.9	0.0	0.4	1.7	2.4	0.8	1.3	1.2	0.6
	C3 (평2330-2459)	2.0	2.3	8.3	0.0	0.0	1.5	3.0	3.2	3.1	1.8	2.2	2.0	1.4	1.4	1.6
	C4 (토0600-0700)	1.2	1.2	4.6	0.0	0.0	1.4	1.6	1.0	1.1	0.6	1.1	0.8	1.5	1.4	1.3
	C5 (토2400-2459)	-	-	7.6	-	-	1.4	-	-	2.5	-	-	1.9	-	-	1.7
	C6 (일0600-0700)	0.8	1.0	2.4	0.0	0.0	0.9	0.5	0.5	0.5	1.0	1.1	0.4	0.1	0.0	0.5
	C7 (일2330-2459)	4.3	4.8	9.1	0.0	0.0	0.3	0.0	0.0	2.8	0.0	0.0	2.4	4.3	4.8	3.5
	기 타	1.5	1.6	-	0.0	0.0	-	2.0	1.5	-	1.2	1.7	-	1.7	1.5	-
	소 계	1.5	1.8	5.3	0.0	0.0	1.0	1.5	1.7	1.6	1.5	2.1	1.4	1.4	1.4	1.3

'93년 11월 22일부터 '93년 11월 28일까지 시급별 시청률

- 분석기간 : '93년 11월 22일부터 93년 11월 28일까지
- 분석대상 : 4세이상 모든개인
- 분석방송국 : 4대 방송국(KBS1, KBS2, MBC, SBS)

(단위 : %)

	시 급	가중 평균		TOTAL	KBS1			KBS2			MBC			SBS		
		프로 광고	SPOT 광고	시간대	프로 광고	SPOT 광고	시간대	프로 광고	SPOT 광고	시간대	프로 광고	SPOT 광고	시간대	프로 광고	SPOT 광고	시간대
SA	SA1(평2000-2230)	6.2	5.0	29.0	0.0	0.0	4.2	5.5	4.7	8.5	8.0	7.5	10.0	4.7	3.1	6.3
	SA2(토1900-2230)	6.2	4.8	30.9	0.0	4.1	5.8	4.5	3.8	6.7	9.5	9.3	12.5	3.2	2.2	5.8
	SA3(일1900-2230)	7.1	5.6	32.6	0.0	4.7	4.3	3.6	3.8	4.5	11.4	11.0	16.2	5.9	3.4	7.5
	기 타	6.4	6.2	-	0.0	0.0	-	4.9	5.8	-	9.4	8.6	-	4.9	3.9	-
	소 계	6.4	5.3	29.8	0.0	4.4	4.4	5.0	4.7	7.7	8.9	8.3	11.2	4.7	3.2	6.4
A	A1 (평1900-2000)	5.4	3.9	22.4	0.0	0.0	3.7	5.1	3.9	6.4	6.1	4.0	6.4	4.8	0.0	5.9
	A2 (평2230-2300)	4.1	5.4	25.1	0.0	0.0	2.7	3.9	4.1	3.2	6.9	7.2	12.4	4.1	4.4	6.9
	A3 (토1800-1900)	6.0	4.5	24.4	0.0	0.0	5.1	4.2	3.4	3.6	8.4	5.6	10.9	4.1	0.0	4.7
	A4 (토2230-2330)	3.1	4.0	27.5	0.0	0.0	2.5	3.7	3.2	8.8	0.0	5.5	12.6	2.4	4.1	3.6
	A5 (일0800-1900)	4.6	3.7	20.6	0.0	2.0	3.6	3.4	2.9	4.5	6.3	5.1	7.2	4.2	3.3	5.2
	A6 (일2230-2300)	9.2	4.5	28.3	0.0	0.0	4.4	1.7	2.2	7.0	7.0	5.6	9.3	10.0	6.3	7.6
	기 타	4.0	4.5	-	0.0	0.0	-	3.8	6.2	-	4.6	5.4	-	4.1	2.9	-
	소 계	4.7	4.3	24.2	0.0	2.0	3.4	3.9	3.8	5.1	6.2	5.5	9.6	4.5	3.7	6.1
B	B1 (평0700-1000)	3.0	3.0	12.9	0.0	0.0	3.0	2.2	2.2	2.4	3.7	4.2	4.2	3.1	3.0	3.4
	B2 (평1730-1900)	3.8	2.8	17.4	0.0	0.0	3.5	6.1	3.8	6.5	3.0	2.5	4.1	2.8	2.2	3.3
	B3 (평2300-2330)	3.3	4.5	18.8	0.0	0.0	2.9	0.0	0.0	5.7	4.1	4.5	4.3	2.9	0.0	5.9
	B4 (토0700-1800)	3.1	2.7	12.6	0.0	1.9	2.5	2.1	1.9	2.1	3.9	4.0	4.8	3.1	2.6	3.3
	B5 (토2330-2400)	4.2	-	16.4	0.0	-	1.7	0.0	-	8.2	4.2	-	4.0	0.0	-	2.4
	B6 (일0700-0800)	2.5	1.7	7.7	0.0	0.0	1.4	3.3	0.6	1.2	2.2	2.9	2.7	0.9	0.2	2.4
	B7 (일2300-2330)	1.6	2.9	27.0	0.0	0.0	2.7	1.3	0.0	2.8	2.0	2.9	4.8	0.0	0.0	16.7
	기 타	3.0	1.6	-	0.0	0.0	-	6.2	0.0	-	3.4	1.8	-	1.7	1.2	-
	소 계	3.2	2.8	16.3	0.0	1.9	2.9	3.0	2.3	4.6	3.5	3.4	4.2	2.9	2.5	4.6
C	C1 (평0600-0700)	1.1	0.7	4.3	0.0	0.0	1.5	0.3	0.3	0.7	1.4	1.2	1.3	0.8	0.6	0.8
	C2 (평1000-1730)	1.2	-	1.9	0.0	-	0.3	0.0	-	0.4	0.0	-	0.7	1.2	-	0.4
	C3 (평2330-2459)	2.7	2.7	8.4	0.0	0.0	2.5	2.6	3.3	1.9	3.0	2.5	2.3	2.3	2.3	1.7
	C4 (토0600-0700)	0.8	0.7	3.3	0.0	0.0	1.0	0.8	0.8	0.8	1.1	0.9	1.0	0.5	0.4	0.6
	C5 (토2400-2459)	-	-	9.7	-	-	1.2	-	-	3.8	-	-	3.4	-	-	1.4
	C6 (일0600-0700)	0.7	0.1	1.6	0.0	0.0	0.7	0.1	0.1	0.2	0.8	0.0	0.6	0.1	0.0	0.2
	C7 (일2330-2459)	4.4	4.8	13.4	0.0	0.0	0.9	0.0	0.0	3.2	0.0	0.0	2.6	4.4	4.8	6.7
	기 다	1.7	2.3	-	0.0	0.0	-	1.2	1.9	-	2.9	3.0	-	1.4	1.9	-
	소 계	1.4	1.9	5.3	0.0	0.0	1.3	1.2	1.9	1.2	1.8	2.1	1.5	1.1	1.8	1.2

APPENDIX C
THE SAMPLE BBD-L AND DOUBLE LOG-LINEAR MODEL RUN OUTPUT WITH DATA BASE TABLE

****
EVALUATION OF KOREAN TELEVISION ADVERTISING SCHEDULES
****

Frequency	Vehicle	Network Ad	Spot Ad	D.Log Model	Difference	Ratio
f	%f	%f	%f	%f	%f	%f
0	26.29	35.30	40.62	32.25	3.04	91.37
1	18.33	18.85	18.46	21.04	2.19	111.62
2	13.58	12.51	11.60	13.22	0.71	105.70
3	10.23	8.82	7.94	9.09	0.27	103.09
4	7.75	6.39	5.65	6.48	0.10	101.50
5	5.89	4.69	4.10	4.71	0.02	100.37
6	4.47	3.47	3.01	3.46	0.02	99.52
7	3.39	2.58	2.23	2.55	0.03	98.84
8	2.57	1.92	1.65	1.89	0.03	98.28
9	1.94	1.43	1.23	1.40	0.03	97.81
10	1.45	1.07	0.92	1.04	0.03	97.40

AED: 3.53% AER: 3.04% AER Ratio: 104.71%

Summary Evaluation	Vehicle	Network Ad	Spot Ad	D.Log Model	Difference
Reach	73.71%	64.70%	59.38%	67.75%	3.04%
Effective Reach	41.81%	33.35%	29.31%	33.49%	0.14%
Average Frequency	4.01	3.67	3.56	3.54%	0.13%
Gross Rating Points	295.78%	237.68%	211.16%	239.96%	2.28%
Cost Per Thousand	$ 0.96	$ 1.20	$ 2.42	1.19%	0.01%

Vehicle L.	Rating(V)	Rating(P)	Rating(S)	Cost(P)	Cost(S)	Ads
KBS-SA1	8.13	5.43	4.60	$ 770	$ 2,039	4
SBS-SA1	7.00	5.15	3.38	$ 773	$ 2,039	4
SBS-SA2	7.80	5.70	3.68	$ 773	$ 2,039	4
KBS-SA3	5.40	3.65	3.25	$ 773	$ 2,039	4
KBS-A1	4.60	3.70	3.15	$ 628	$ 1,188	4
SBS-A1	6.40	5.38	6.00	$ 631	$ 1,188	4
MBC-A5	7.55	6.58	5.68	$ 631	$ 1,188	4
KBS-B1	2.58	2.43	2.45	$ 426	$ 345	4
SBS-B1	4.95	4.83	4.80	$ 427	$ 345	4
KBS-B2	3.78	3.60	2.53	$ 426	$ 345	4
KBS-B4	3.13	2.65	2.50	$ 426	$ 345	4
KBS-B3	6.80	5.75	6.05	$ 426	$ 345	4
MBC-B2	3.23	2.53	2.10	$ 427	$ 345	4
MBC-C3	2.18	1.65	2.18	$ 203	$ 168	4
MBC-C4	0.83	0.78	0.88	$ 202	$ 168	2
			TOTALS:	$ 31,364	$ 56,168	58

Column	Description
Frequency D.:	Frequency or exposure distribution which is the percent of the target audience exposed to each frequency level of the schedule.
Frequency (f)	Frequency which is the number of opportunities target audience members have to see the vehicles or commercials in the schedule. For convenience, the frequency column is truncated at 10+ indicating opportunities for exposure ten or more times.
Vehicle:	The percentage of the target exposed to the vehicles within the schedule at each frequency level (%f) generated by the BBD-L model.
Network Ad:	The percentage of the target exposed to the network commercial within the schedule at each frequency level (%f) generated by the BBD-L model.
Spot Ad:	The percentage of the target exposed to the spot commercial within the schedule at each frequency level (%f) generated by the BBD-L model.
D. Log Model:	The percentage of the target exposed to the program commercial within the schedule at each frequency level (%f) generated by the Double Log-Linear model.
Difference:	The absolute difference between *Network Ad* and *D. Log Model*
Ratio:	The ratio of *D. Log Model* to *Network Ad* at each frequency level (%f).
AED:	Average error in message exposure distribution generated by the Double Log-Linear model (%)
AER:	Average error in reach (1+) generated by the Double Log-Linear model (%).
AER Ratio:	The ratio of reach (1+) generated by the Double Log-Linear model to reach (1+) generated by the BBD-L model (%).
Summary evaluation:	The column including the various media evaluation factors obtained from the *frequency distribution* table.
Reach (1+):	The percentage of the target audience exposed one or more times to the vehicles or the messages within the schedule. Under the *Vehicle, Network Ad, and Spot Ad* banner, *Reach (1+)* is the percentage of the target exposed one or more times to the vehicles and program and spot commercials within the schedule generated by the BBD-L model, while under the *D. Log Model* banner, *Reach (1+)* is the percentage of the target exposed one or more times to the

program commercials within the schedule generated by the Double Log-Linear Model. *Difference* in the sixth column is the absolute difference between *Network Ad and D. Log Model* in Reach (1+).

Effective Reach: or Reach (3+) The percentage of the target audience exposed three or more times to the vehicles or the messages within the schedule. Under the *Vehicle, Network Ad, and Spot Ad* banner, *Effective Reach* is the percentage of the target exposed three or more times to the vehicles and program and spot commercials within the schedule generated by the BBD-L model, while under the *D. Log Model* banner, *Effective Reach* is the percentage of the target exposed three or more times to the program commercials within the schedule generated by the Double Log-Linear Model. *Difference* in the sixth column is the absolute difference between *Network Ad and D. Log Model* in *Effective Reach.*

Gross Rating Points (GRPs): The sum of the ratings of all of the vehicles or the ads in the schedule. Under the *Vehicle, Network Ad, and Spot Ad* banner, *Gross Rating Points (GRPs)* is the sum of the ratings of all of the vehicles and program and spot commercials in the schedule generated by the BBD-L model, while under the *D. Log Model* banner, it is the sum of the ratings of all of the program commercials in the schedule generated by the Double Log-Linear model. *Difference* in the sixth column is the absolute difference between *Network Ad and D. Log Model* in *Gross Rating Points (GRPs).*

Average Frequency: The mean number of times those reached by the schedule are exposed to the vehicles or the messages within the schedule. Under the *Vehicle, Network Ad, and Spot Ad* banner, *Average Frequency* is the mean number of times those reached by the schedule are exposed to the vehicles and program and spot commercials in the schedule generated by the BBD-L model, while under the *D. Log Model* banners, *Average Frequency* is the mean number of times those reached by the schedule are exposed to the program commercials in the schedule generated by the Double Log-Linear model. *Difference* in the sixth column is the absolute difference between *Network Ad and D. Log Model* in *Average Frequency.*

Cost-Per-Thousand: Cost-per-thousand impressions (CPM). Cost to achieve every one thousand impressions using a particular vehicle, advertising, or schedule. Under the *Vehicle, Network Ad, and Spot Ad* banner, *Cost-Per-Thousand* is the cost for one thousand vehicle and program and spot commercial impressions against the target generated by the BBD-L model, while under the *D. Log Model* banners, *Cost-Per-Thousand* is the cost for one thousand program commercial impressions against the target generated by the Double Log-Linear model. *Difference* in the sixth column is the absolute difference between *Network Ad and D. Log Model* in *Cost-Per-Thousand.*

Vehicle L.:	The list of programs which are included in the television advertising schedule.
Rating (V):	The ratings of the television programs in the schedule.
Rating (P):	The ratings of the program commercials in the schedule.
Rating (S):	The ratings of the spot commercials in the schedule.
Cost (P):	The costs of the program commercials in the schedule.
Cost (S):	The costs of the spot commercials in the schedule.
Ads:	The number of insertions of program or spot commercials in the schedule.

APPENDIX D
COMPUTER BASIC PROGRAM OF NETWORK TELEVISION ADVERTISING SCHEDULE EVALUATION MODEL

```
REM ---------------------------------------------------------------------------------------------
REM  THIS PROGRAM IS DESIGNED FOR CALCULATING VEHICLE AND
REM  MESSAGE EXPOSURE DISTRIBUTIONS FOR A KOREAN TELEVISION
REM  SCHEDULE BY THE BETA BINOMIAL DISTRIBUTION WITH LIMITED
REM  INFORMATION MODEL AND THE DOUBLE LOG-LINEAR MODEL.
REM ---------------------------------------------------------------------------------------------

DIM  VN$(50), Ri(50,2), VC(50,50), N(50), E(50,2), C(50), r2i(50), rij(50,50),
     V(50), Y(50), AED(50), AED1(50), RT(50), M(50)

     TSIZE=11,000,000#
     PTCOST=0:STCOST=0:N=0:GRP=0:RTSUM(0)=0:RTSUM(1)=0

PRINT  "Do you want to create a NEW schedule OR use the EXISTING file?"
INPUT "1) for new schedule 2) for the other";AA

ON AA GOSUB CREATE, USE

REM ----------------------
REM  DATA INPUT
REM ----------------------

CREATE:
     INPUT  "INPUT THE NUMBER OF VEHICLES IN THIS SCHEDULE"; X

     FOR I=0 TO X-1
     PRINT  "Input Vehicle name, Message (P), Message (S), Vehicle(decimal), Costs
             (P), Costs (S), Insertions"
     PRINT  "Separating each by a comma"
     INPUT  VN$(I), Ri(I,0), Ri(I,1), Ri(I,2), VC(I,0), VC(I,1), N(I)
     GOSUB  CHAR
     NEXT I

     OPEN "TEXT$" FOR OUTPUT AS #1
     WRITE #1, X
     FOR I=0 TO X-1
     WRITE #1, VN$(I), Ri(I,0), Ri(I,1), Ri(I,2), VC(I,0), VC(I,1), N(I)
     NEXT I
     CLOSE #1
```

```
USE:
        TEXT$=FILES$(1)
        OPEN "TEXT$" FOR INPUT AS #2
        INPUT #2, X
        FOR I=0 TO X-1
        INPUT #2,VN$(I), Ri(I,0), Ri(I,1), Ri(I,2), VC(I,0), VC(I,1), N(I)
        GOSUB CHAR
        NEXT I
        CLOSE #2

RTAV(0)=(RTSUM(0)/N)*100
RTAV(1)=(RTSUM(1)/N)*100

CHAR:
        N=N+N(I)
        PTCOST=PTCOST+VC(I,0)*N(I)
        STCOST=STCOST+VC(I,1)*N(I)

        RTO(I,0)=Ri(I,0)/Ri(I,2)
        RTO(I,1)=Ri(I,1)/Ri(I,2)

        RTSUM(0)=RTSUM(0)+RTO(I,0)*N(I)
        RTSUM(1)=RTSUM(1)+RTO(I,1)*N(I)

RETURN

REM -----------------------------------------------
REM  CALCULATING SELF-PAIR SUM
REM -----------------------------------------------

FOR t=0 TO 2

        r2isum=0

        FOR I=0 TO X-1
                IF N(I)=1 OR N(I)=0 THEN COMB=0
                Z=N(I):R=2
                COMB=1
                RT=1.7946#

                FOR G=1 TO R
                        COMB=COMB*((Z-G+1)/(R-G+1))
                NEXT G

                C(I)=COMB
                r2i(I)=-.0065+(RT)*Ri(I,t)-(1.3308)*Ri(I,t)^2
                r2isum=r2isum+C(I)*r2i(I)
                GRP(t)=GRP(t)+Ri(I,t)*N(I)

        NEXT I
```

```
    rbar1=GRP(t)/N

REM ------------------------------------------------
REM CALCULATING CROSS-PAIR SUM
REM ------------------------------------------------

    rijsum=0

    FOR I=0 TO X-2
       FOR J=I+1 TO X-1
          rij(I,J)=-.00149 + (1.0095)*(Ri(I,t)+Ri(J,t))-(1.5012)*Ri(I,t)*Ri(J,t)
          rijsum=rijsum+N(I)*N(J)*rij(I,J)
       NEXT J
    NEXT I

REM ----------------------------------------------------------------------------------
REM CALCULATING A, B, AND D PARAMETERS IN BBD-L MODEL
REM ----------------------------------------------------------------------------------

    R=2
    COMB=1

    FOR G=1 TO R
          COMB=COMB*((N-G+1)/(R-G+1))
    NEXT G

    rbar2=(r2isum+rijsum)/COMB
    A=(rbar1*(rbar2-rbar1))/(2*rbar1-rbar2-rbar1^2)
    B=(A*(1-rbar1))/(rbar1):D=A+B
    L=N:IF L>45 THEN L=45

REM ----------------------------------------------------------------
REM CALCULATING BBD EXPANSION FORMULA
REM ----------------------------------------------------------------

    FOR I=0 TO L
          IF I=0 THEN GOTO EX
          V(I)=V(I-1)*(A+I-1)/(B+N-I)

          R=I
          COMB=1
          FOR G=1 TO R
                COMB=COMB*((N-G+1)/(R-G+1))
          NEXT G

          E(I,t)=COMB*V(I)

    EX:
          E(0,t)=1
```

```
            FOR J=0 TO N-1
                E(0,t)=E(0,t)*((B+J)/(D+J))
            NEXT J

            V(0)=E(0,t)
        NEXT I

REM -----------------------------------------------------------
REM  CALCULATING SUMMARY EVALUATION
REM -----------------------------------------------------------

        REACH(t)=(1-E(0,t))*100
        REACH3(t)=(1-E(0,t)-E(1,t)-E(2,t))*100
        AF(t)=GRP(t)*100/REACH(t)
        GI(t)=GRP(t)*TSIZE
        IF t=1 THEN CC=STCOST ELSE CC=PTCOST
        CPM(t)=CC/(GI(t)/1000)

NEXT t

REM ---------------------------------------------------------------------------------------------------
REM  ESTIMATING MESSAGE EXPOSURE DISTRIBUTIONS OF KOREAN
REM  TELEVISION ADVERTISING SCHEDULES BY THE DOUBLE LOG-LINEAR
REM  MODEL
REM ---------------------------------------------------------------------------------------------------

 MGRP = GRP(2)*100

FOR I=1 TO L

        Z=E(I,2)*100
        Y(I) = -.252 + .954 * LOG(Z) - .257 * LOG(I) + .236 * LOG(N) - .067 * LOG
        (MGRP) - .020*LOG(X)
        M(I)=EXP(Y(I))
        MREACH=MREACH + M(I)
        MMGRP=MMGRP + I*M(I)

NEXT I

M(0)=100 - MREACH
MREACH (3)=100-M(0)-M(1)-M(2)
MAF=MMGRP/MREACH
MGI=(MMGRP/100)*TSIZE
MCPM=PTCOST/(MGI/1,000)

FOR I = 0 TO L

        AED(I)=(E(I,0)*100)-M(I)
        AED1(I)=ABS (AED(I))
        RT(I)=(E(I,0)*100)/M(I)
```

```
NEXT I

FOR I = 1 TO L

        ASUM=ASUM+ABS (AED(I))

NEXT I

AER=REACH(0)-MREACH
AER1=ABS(AER)
RRT=(MREACH/REACH(0))*100

AEE=REACH3(0)-MREACH(3)
AEE1=ABS(AEE)

AEF=AF(0)-MAF
AEF1=ABS(AEF)

AEG=(GRP(0)*100)*100
AEG1=ABS(AEG)

AEC=CPM(0)-MCPM
AEC1=ABS(AEC)

AVGR(0)=(GRO(0)/N)*100
AVGR(1)=(GRP(1)/N)*100
AVGR(2)=(GRP(2)/N)*100
NX=N/X

REM ---------------------------------------
REM  PRINT OUTPUT RESULTS
REM ---------------------------------------

OPEN "BBDOUT1" FOR OUTPUT AS #3

        PRINT #3,
        PRINT #3,
        PRINT #3,
        PRINT #3,
        PRINT #3,
        PRINT #3, SPC(18)STRING$(54,"*")
        PRINT #3, SPC(19) "EVALUATION OF KOREAN TELEVISION
                  ADVERTISING SCHEDULES"
        PRINT #3, SPC(18) STRING$(54,"*")
        PRINT #3,
        PRINT #3,
        PRINT #3,
```

```
PRINT #3, SPC(7) "Frequency D." SPC(3) "Vehicle" SPC(2) "Network Ad"
          SPC(4) "Spot Ad" SPC(3) "D.Log Model "SPC(3) "Difference"
          SPC(3) "Ratio"
PRINT #3, SPC(6) STRING$(12,"-") SPC(4) STRING$(8,"-") SPC(3)
          STRING$(10,"-") SPC(4) STRING$(8,"-") SPC(4) STRING$(9,"-
          ") SPC(4) STRING$(9,"-") SPC(4) STRING$(9,"-")
PRINT #3, SPC(17)"f" SPC(10) "%f"SPC(10) "%f" SPC(10) "%f" SPC(10)
          "%f" SPC(11) "%f" SPC(11) "%f"

PRINT #3, SPC(10) STRING$(8,"-") SPC(5) STRING$(8,"-") SPC(4)
          STRING$(8,"-") SPC(4) STRING$(8,"-") SPC(5) STRING$(8,"-")
          SPC(5) STRING$(8,"-") SPC(8) STRING$(8,"-")

FOR I=0 TO 10
    PRINT #3, SPC(15) USING "##       ##.##      ##.##      ##.##
    ##.##      ##.##       ###.##";I, E(I,2)*100, E(I,0)*100, E(I,1)*100, M(I),
    AED(I), RT(I)*100
NEXT I

PRINT #3,
PRINT #3, SPC(20) USING"AED:  ###.##%   AER: ##.##%  AER Ratio:
          ###.##%"; ASUM, AER1, RRT
PRINT #3,
PRINT #3,
PRINT #3, SPC(7) "Summary Evaluation" SPC(5) "Vehicle" SPC(2) "Program
          Ad" SPC(4) "Spot Ad" SPC(4) "D.Log Model" SPC(4) " Difference"
PRINT #3, SPC(7) "------------------" SPC(5) "-------" SPC(2) "----------" SPC(4)
          "-------" SPC(4) "--------" SPC(4) "--------"
PRINT #3, SPC(7) USING "Reach                ##.##%     ##.##%     ##.##%
          ##.##%     ##.##%";REACH(2), REACH(0), REACH(1),
          MREACH, AER1
PRINT #3, SPC(7) USING "Effective Frequency    ##.##%     ##.##%
          ##.##%     ##.##%     ##.##%";REACH3(2), REACH3(0),
          REACH3(1),  MREACH(3), AEE1
PRINT #3, SPC(7) USING "Average Frequency    ##.##      ##.##      ##.##
          ##.##%     ##.##%";AF(2), AF(0), AF(1), MAF, AEF1
PRINT #3, SPC(7) USING  "Gross Rating Points  ###.##%    ###.##%
          ###.##%    ###.##%    ###.##%";GRP(2)*100, GRP(0)*100,
          GRP(1)*100, MMGRP, AEG1
PRINT #3, SPC(7) USING "Cost Per Thousand     $##.##     $##.##    $##.##
          ###.##%    ###.##%";CPM(2), CPM(0), CPM(1), MCPM, AEC1
PRINT #3,
PRINT #3,
PRINT #3,
PRINT #3, SPC(7)"Vehicle L" SPC(3) "Rating(V)" SPC(3) "Rating(P)" SPC(3)
          "Rating(S)" SPC(4) "Cost(P)" SPC(4) "Cost(S)" SPC(4) "Ads"
PRINT #3, SPC(7) "---------" SPC(3) "--------" SPC(4) "--------" SPC(4) "--------
          " SPC(4) "-------" SPC(4) "-------" SPC(4) "----"
```

```
FOR I=0 TO X-1
PRINT #3, SPC(7) VN$(I) SPC(6) USING"##.##      ##.##      ##.##
          $##,###    $##,###    ##";Ri(I,2)*100 , Ri(I,0)*100, Ri(I,1)*100,
          VC(I,0), VC(I,1), N(I)
NEXT I

PRINT #3, TAB(55)"--------" SPC(4) "-------" SPC(4) "----"
PRINT #3,
PRINT #3, TAB(38) "TOTALS:" SPC(10) USING"$###,###    $###,###    ##";
          PTCOST, STCOST, N
PRINT #3,
PRINT #3, SPC(7) "Average Ratio of Message/Vehicle Ratings:" SPC(3) USING
          "##.##%(P)  ##.##%(S)"; RTAV(0), RTAV(1)
PRINT #3, SPC(7) "Average Rating of the Schedule:" SPC(3) USING
          "##.##%(V)  ##.##%(P)  ##.##%(S)"; AVGR(2), AVGR(0),
          AVGR(1)
PRINT #3, SPC(7) USING "Total Insertions/Number of Programs: ##.##
          Number of Programs: ###"; NX, X

CLOSE #3
END
```

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BIOGRAPHICAL SKETCH

Kyung Yul Lee was born in Taegu City, Korea, on December 19, 1958, the first son of Eun Kyung Lee and Young Hee Park and raised there until graduating from high school. In 1978, he entered the Han Kuk University of Foreign Studies in Seoul, Korea, to major in international communication. Two years later, he began to serve in the Korean Army and was discharged from the Army as a sergeant in October, 1982. After graduating from the Han Kuk University of Foreign Studies in Seoul, Korea, with his bachelor's degree in international communication in 1985, he came to the United States to further his study in advertising at the University of Texas at Austin in August, 1986. After completing his master's work in advertising at the University of Texas at Austin in 1989, he started his doctoral program at the University of Florida specializing in advertising media planning. After completing his Ph.D. degree, Kyung Yul Lee plans to return to Korea and pursue an advertising career in teaching and research at the university.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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